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# THE HISTORICAL AND PHYSICAL GEOGRAPHY OF THE DEAD SEA REGION.

AN ADDRESS BY THE

REV. PUTNAM CADY.

The Dead Sea is the most mysterious body of water on the globe, and the region around it is physically the most remarkable in the world. Although the sea is only twenty miles from Jerusalem, and almost in the heart of a country historically famous for more than five thousand years, yet it has never been thoroughly explored, and many parts of the mountains along the eastern shore are *terra incognita.*

In the Talmud the lake is called The Sea of Sodom. The Bible calls it The Salt or East Sea. Josephus gives its name as Asphaltic Lake; and by Jerome it is called The Dead Sea. By the Arabs, however, it is named Bahr Lût ("Sea of Lot"). It will be noticed that several of these names associate it with the destruction of the Cities of the Plain. When the explorer realizes that this is the lowest spot on the surface of the earth, and experiences the intense heat as the sun pours his burning rays down into this gulf, he will appreciate the words of Professor George Adam Smith when he says: "In this awful hollow, this bit of the infernal regions come up to the surface, this hell with the sun shining into it, primitive man laid the scene of God's most terrible judgment on human sin. The glare of Sodom and Gomorrah is flung down the whole length of Scripture history."

The approaches to the Sea are in keeping with its character, and prepare one for the wild and lonely shore to be visited. The way by Bethlehem and Engedi leads through the barren wilderness in which David hid from Saul. Ever since that time it has been a place of refuge for outlaws and wandering Bedouin. Winding wadies that are dry and hot, save when heavy storms in the rainy

season send torrents rushing down for a few hours, stretch out in all directions. The approach by either Mar Saba down the Wady en-Nâr ("Valley of Fire"), or by Bethany and the Wady Kelt, is very much of the same character. It has been aptly described as "twenty miles of chaos." At many places on the road along the Wady Kelt a few steps will take the traveller to the edge of a cliff down which he may look hundreds of feet to the stream below.

Perhaps the best description of the physical surroundings of this mysterious sea is given by Professor George Adam Smith in his *Historical Geography of the Holy Land.* "No one can live in Judea," he says, "without being daily aware of an awful deep which bounds it on the east—the lower Jordan Valley and the Dead Sea. From Bethel, from Jerusalem, from Bethlehem, from Tekoa, from the heights above Hebron, and from fifty points between, you look down into that deep, and you feel Judea rising from it about you almost as a sailor feels his narrow deck or a sentinel the sharp-edged platform of his high fortress. From the hard limestone of the range on which you stand the land sinks swiftly through softer formations, desert and chaotic, to a depth of which you cannot see the bottom—but you know that it falls far below the level of the ocean—to the coasts of a bitter sea. Across this emptiness rise the hills of Moab, high and precipitous; and it is their bare edge, almost unbroken and with nothing visible beyond, which forms the eastern horizon of Judea. The depth, the singularity of that gulf and its prisoned sea, the high barrier beyond, conspire to produce on the inhabitants of Judea a moral effect such as is created by no other frontier in the world."

The eastern shore of the Sea is different in many respects from the western. The mountains rise precipitously to a height of from two thousand five hundred to more than three thousand feet. But back of this range is the fertile tableland of Moab, fifty miles long and twenty wide. With this nothing along the western shore can compare. Ruins of towns are scattered all over the country, and give evidence of a vast population in past centuries.

This section is of great interest to the archæologist and the historian. While it is not really in line with the topic assigned me, I feel that I must call your attention to one point of interest. On the very border of Moab—almost on the edge of the great Arabian desert—stands a remarkable ruin. It is a palace five hundred and seventy feet square, having an immense paved court. It has in part been photographed several times; but, as perhaps, not over twenty Europeans have seen it, its beauty is not well known. It was discov-

ered in 1872 by Canon Tristram, and some account of it may be found in his book on *The Land of Moab*. Merrill also speaks of it in his volume *East of the Jordan*. This ruin, which is called Mashita, or Mashetta, gives us the finest work in art to be found in all that country, and can scarcely be surpassed by anything of the kind in the world. The whole front is decorated with magnificent and delicately-sculptured representations of animals, fruits, flowers, vines, and leaves. Immense rose-bosses break the surface and emphasize with light and shade the beauty of the front.

Who the builder was is not definitely settled. Many suppose that Chosroes of Persia, whose armies swept over this country about 614 A. D., erected it. Others believe that an early Christian emperor or some mighty Mohammedan prince built it. A somewhat fanciful story of its construction is given in *Harper's Monthly* for June, 1901. I have recently learned that the Sultan has presented this palace to Emperor William of Germany. Without doubt the Emperor will leave it where it is.

Having some idea of the surroundings of the Dead Sea, we now proceed to explore its surface. Not a solitary dwelling is on its coasts, and there is no living thing in its waters. As we stand on the north shore, the Sea stretches out some forty-two miles toward the south, and is, on an average, eight miles wide. The water is of a greenish-blue, and as clear as crystal. A soft haze covers the mountains of Moab on the east, and the Judean hills on the west loom up dark and desolate in their grandeur. Jerusalem is only twenty miles away, but it is three thousand eight hundred feet above us. Far to the west roll the blue waves of the Mediterranean, but they are one thousand three hundred feet higher than the spot on which we stand.

Either on this plain or on the one at the south end of the Sea once stood the cities that were overthrown by the fire of the Lord. Professor George Adam Smith is inclined to believe that the south end of the Sea is the place where the doomed cities were. Canon Tristram and Dr. Merrill would place them at the north end. Many mounds on the plains of Shittim, at the northeast end of the Sea, await the spade of the excavator. Possibly they may throw light upon the question. It would seem, however, that there is no reason for believing the cities to be beneath the waters of the Dead Sea. The Bible nowhere makes the statement that they were thus overthrown. Fire and brimstone rained down upon them, and they were overwhelmed. Lot stood at a point near Bethel, and saw all the plain, that it was well watered, and chose it because of its fertility.

This he might do if the plain were at the north end of the Sea. He could hardly make this observation if it were at the south end, more than fifty miles away. This, and the fact that Chedorlaomer swept past Hazazon-Tamar or Engedi before he attacked the cities, indicates that our supposition is probably correct. However, the final word cannot be said until the Turkish or some other Government allows full investigations to be made.

I have said that this whole region is physically the most remarkable in the world. Perhaps a few facts about the whole Jordan Valley may give us a better appreciation of our situation as we sail out upon this strange body of water.

Mount Hermon, far to the north, is about nine thousand feet high. One of the sources of the Jordan rises on its western slope ten hundred and fifty feet above sea-level. This joins others near the site of ancient Dan, and together they flow twelve miles until they enter the Waters of Merom or Lake Huleh, which is only six feet above the level of the Mediterranean. Passing through Lake Huleh, the Jordan hastens eleven miles down to the Sea of Galilee, which is six hundred and eighty feet below the level of the Mediterranean. From Galilee to the Dead Sea the distance is about sixty-five miles in a straight line; but the river is so crooked that it meanders over nearly two hundred miles before it empties into the Dead Sea where it is, as I have indicated, thirteen hundred feet below sea-level. There can, of course, be no outlet for the Dead Sea, and the volume of from six to ten million tons of water that the Jordan throws into it every twenty-four hours must be carried away by evaporation.

Under these conditions it may be readily imagined that exploring the Dead Sea is no easy task. Costigan was the first in modern times to make the attempt, and he lost his life under the burning rays of that fierce sun as they poured down into this "bit of the infernal regions brought up to the surface." Molyneaux did not proceed far in his boat before a storm overtook him, and he died of exhaustion and fever. In 1847 our Government sent out an expedition under Lieut. Lynch, who spent twenty-two days on the Sea, and has given us nearly all that we know of its shore-line and various depths. Lynch also faced the dangers met by previous explorers, and on several occasions his expedition nearly came to an untimely end. He describes the storm that met him as he emerged from the mouth of the Jordan as being the fiercest he had ever faced. The metal plates of one of his boats were bent by the force of the waves. It was like a bombardment of waves of lead.

Some idea of their weight may be gained from the fact that while ordinary sea water contains from 4 to 6 per cent. of solid matter, the Dead Sea water has from 24 to 26 per cent. Possibly Lieut. Lynch's own words may be of interest: "At times it seemed as if the Dread Almighty frowned upon our efforts to navigate a sea the creation of His wrath. There is a tradition among the Arabs that no one can venture upon this sea and live. Repeatedly the fates of Costigan and Molyneaux had been cited to deter us. . . . We prepared to spend a night upon the dreariest wastes we had ever seen." The Bedouin told Lynch that they had often heard of the cruelty of the Franks, but never supposed they were so cruel as to send one of their own number to a place so desolate. Farther on in his narrative he speaks of being "in the midst of a profound and awful solitude." "Surely," he says, "the curse of God is upon this unhallowed sea."

Lieut. Lynch's discoveries may be summed up in the following facts: The bottom of the Sea consists of two submerged plains, the one at the southern end being thirteen feet below the surface and the one at the northern end thirteen hundred feet below. Running through the northern plain from north to south, and corresponding with the Jordan Valley and the Wady el-Jib at the south end of the Sea, is a depression in the bottom of the Sea which marks the line of the great fault in the earth's crust. It has been generally believed that the earth split open in a distant age, and that the side on the west fell in some five thousand feet, while on the eastern shore the strata of sandstone were depressed but slightly. On the western shore we therefore see the Cretaceous limestone, but the lower Cretaceous Nubian sandstone is far beneath. As this depression did not occur on the eastern shore, we see there the glowing colours of the lower Cretaceous Nubian sandstone, on the top of which, crowning the highest points, is the Cretaceous limestone corresponding with the strata on the western shore, but thousands of feet higher.

Prof. William Libbey, of Princeton, opposes this theory, and denies that the sandstone on the eastern shore is Nubian. He backs up his assertion by facts he discovered a little more than a year ago, and which, I believe, he presented in a lecture before this Society. Prof. Libbey claims that the sandstone on the limestone is a deposit. Erosion laid bare the limestone along the western shore, but on the eastern coast the currents were not strong enough to wear it away. He declares that the western shore could not have fallen five thousand feet, as the dip of the strata

there is not sufficient to indicate it. There was a fault in the earth's surface, and with the rush of water came a great deposit of sediment. This hardened into sandstone, which was finally worn away.

I have never noticed sandstone along the western coast of the Dead Sea, but Prof. Libbey has no doubt that patches of it are to be found. The strongest evidence he advances in support of his theory is discovered at Petra, where he is certain that the sandstone is a deposit upon the limestone. But having never explored the coasts of the Dead Sea, he has only a strong belief that his statements are in accord with the facts.

This new theory has excited much discussion, and will doubtless lead to a more systematic study of the region. Indeed, we need to verify the measurements of Lieut. Lynch. In that heavy body of dead water his sounding-plummets may not have reported correctly; and, besides, changes may have occurred since his day which would materially alter his findings.

There are two points of interest on the western shore that we may well visit. The first is Engedi, which guarded the pass of Ziz up which Chedorlaomer's host went, as recorded in Genesis. From the shore the ascent is made of three hundred feet to a level space, where is found a spring of warm but sweet water. Here are trees, and also grass. Engedi, famous for its grapes and gardens, stood on this spot. Fourteen hundred feet higher is the top of the pass of Ziz. From this summit the view is extensive. On two occasions I have, from this point, seen snow-crowned Mount Hermon, a hundred and sixty miles away, lifting his hoary head far up in the Syrian sky. Looking toward the south, the dark cliffs of Masada stand out above the gleaming waters of the Sea, and far beyond is the southern end, with the Arabah and its treacherous slime-pits. This depression at the south end of the Sea runs through to the Gulf of Akabah, and separates the red mountains of Edom from the Sinai wilderness.

Leaving Engedi, which has always guarded this pass into the Judean country, and going toward the south, we reach Masada in about four hours of hard travelling over the broken rocks and under the burning sun. Masada is an isolated mass of rock which looks much like Gibraltar. It is about two miles back from the shore, and is separated from the Judean range by deep valleys. One must climb seventeen hundred feet to reach its summit—a task both difficult and dangerous. There was, originally, but one narrow winding path called "the serpent" by which access to the top was possible. That path has been worn away by the storms of centuries,

and the explorer must climb as best he can. Reaching the summit, there bursts upon the view a scene of desolation that can scarcely be equalled. To the west are the broken and barren Judean hills. Turning to the east, the sullen waters of the Sea of Death are seen far below. The ruins that crown the summit bring to mind the awful tragedy enacted there shortly after Jerusalem was captured by Titus. The top of this mass of rock is six hundred yards long, and has an average width of two hundred. It was fortified by the Maccabees two hundred years before Christ. Herod the Great further strengthened it, and supplied it with reservoirs and provisions. It was regarded as the strongest fortress in the land. When Jerusalem fell a thousand Jews retreated to this place, thinking that the Romans would not follow them across the wilderness of barren rock. But the place was invested by Flavius Silva, and was at last captured after the Romans had built a great embankment leading to the top. When the Jews saw that all hope was gone, they killed their wives and children, and then certain men were chosen to stab their comrades. Finally, the last man fell upon his own sword and perished. Since that time the place has been abandoned, and has been visited by only a few explorers in modern times. On the eastern shore of Galilee there is a similar fortress, with a history almost identical with that of Masada. Gamala stood guard over that beautiful lake, and when the Romans captured it the Jews threw their wives and children over the cliffs into the valleys below and leaped after them.

Passing on to explore the eastern shore, a narrative of my own expedition down that coast may serve to bring out the facts of interest discovered there.

A small sail-boat owned by the Turkish Government goes from the mouth of the Jordan to a point opposite Kerak, where it lands supplies for the garrison. These trips are few and far between, and no attempt has ever been made to explore the Moab shore with this unsuitable craft. I found two row-boats on the Jordan, and choosing the larger, started out; but a storm knocked the bottom out of it the first night while we were camping at 'Ain Feshka, and we had the pleasure of walking some twelve miles back to Jericho.

The remaining boat was a flat-bottom skiff twelve feet long. It was, doubtless, the smallest that ever navigated those waters. Having secured the services of two men at Jerusalem, I launched out. Our small boat had no room for stowing away a tent, and our stock of provisions was very limited. We did, however, take a six-gallon tin of fresh water, which we regarded with anxious solicitude.

As no one had examined the Moab shore since Lieut. Lynch's time, and as no photographs had ever been taken of that coast, I determined to go close to shore, land frequently, and take many pictures. No one in Jerusalem could give me any idea of the difficulties I might encounter, and I had only Lynch's narrative to guide me. I noticed, first of all, that many beaches spoken of by him, do not now exist. This is especially true between the Zerka Mâ'aîn (Callirrhoe), and the Wâdy Môjib (Arnon). The waters dash up against the perpendicular cliffs, and there are few landing-places where one might seek refuge in case of a storm. That the level of the Sea is changing seems to be evident, and measurements for determining its nature have been taken for some time at a rock near 'Ain Feshkah. But up to the present time nothing of interest has been found.

A few years ago it was possible to ride on a camel from the western shore over to El-Lisan, but that is impossible now. Also, within a few years, it has been possible to walk between Jebel Usdum and the water; but now the explorer must go behind the cliffs, as the Sea comes quite up to their base. Until 1892 there was an island visible at the north end of the Sea, just opposite the hut where travellers rested as they came down from Jericho. Leading out to this island was a causeway submerged a little below the surface. But the island has now disappeared, and I was unable to find trace of it.

In connection with this rise of the sea-level is a strange fact that I noticed at several places along the coast. A short distance east of the point where the Jordan empties into the Sea stand a number of trees of good size, out at least sixty feet from the shore. They were encrusted with salt, and I did not examine them to see whether they were alive or dead. But at the mouth of the Callirrhoe the bushes extend far out into the water, and are so thick that it is impossible to get near the mouth of the river with a boat. I saw the same kind of growth at several points down the coast where streams of fresh water come tumbling down the cliffs. At the mouth of the Arnon trees of fair size grow in ten feet of water.

After I had reported these facts to the Palestine Exploration Fund, I received a note from Dr. George E. Post, of Beirut, Syria, whose book on the flora of Palestine is authority, asking whether the shrubs and trees were yet alive. They certainly were very much alive, and the theory advanced by Dr. Post, that the level of the Sea has been elevated in recent years, overflowing the land on which this vegetation was growing, is probably correct. If there

is still volcanic action going on in this region, as Sir Charles Warren believes, there may have been both a sinking of the land and a rising of the water-level.

The second fact that I reported is with reference to a strong current setting northward along the Moab shore. I observed it all the way down the coast, and it helped me materially on the return journey. Lieut. Lynch speaks of a current running northward which he observed at Engedi. Sir Chas. Wilson commented on my report, and said: "It would be interesting to ascertain whether this constant current is due to subterranean affluents, to unequal barometric pressure, or to wind action." I am sure that it cannot be due to wind action, because it was very strong when the Sea was perfectly quiet. At one time, when there was not a ripple on the Sea, my Arab was obliged to walk fast to keep up with the boat as I drifted northward, while he followed on shore. I have suggested that possibly the force of the Jordan torrent may go down even as far as El-Lisan and be deflected and divided, returning north along the shores. But that even the Jordan has this force seems hardly probable.

The third fact I reported was that at certain points along the coast great quantities of oil flow out from the rocks and spread over considerable portions of the Sea. As we rowed through these places the water fell from the oars in filmy sheets; and while it was quite rough outside, here the water was calm and the waves reduced to almost imperceptible swells. This oil was observed in greatest quantities before I reached the Callirrhoe. On the shore I found large pieces of pure sulphur and lumps of bitumen weighing several pounds. The Arabs speak of great islands of this bitumen, which were thrown up in recent years by earthquake. A stroke of lightning might easily set this mass on fire, and the scenes of the destruction of Sodom be enacted again. Several weeks after this expedition I crossed the Jordan plain from Nebo, and witnessed a thunderstorm on the Dead Sea. Black clouds seemed to come down to the surface of the water, and sheets of lightning were apparently extinguished in the Sea.

On an evening in May, 1899, Mr. Gray Hill, whose house stands on Mount Scopus, at Jerusalem, witnessed a phenomenon which is in direct connection with my discovery of oil flowing out from the Moab shore. Mr. Hill's dragoman called his attention to repeated flashes of light, which apparently came from a hollow in the mountains on the Moab shore and a little above the surface of the Dead Sea. It was not lightning. It did not flash across the sky,

and the night was cloudless. He reported that it flashed up from this hollow and from nowhere else. These flashes continued at rapid intervals of a second or two until 9.30 P.M., when Mr. Hill retired. His dragoman observed them until 2.30 A.M. This phenomenon occurred just about where I saw the oil flowing in greatest quantities. Mr. Hill said that the scene was most impressive, and set one thinking of Sodom and Gomorrah. He believed that the flashes were caused by the ignition of naptha or petroleum.

The fourth fact that I reported was the following phenomenon: On three successive nights at 7.30 o'clock, when the air was perfectly still and the Sea smooth, a great breaker crashed upon the beach. After a few seconds another came, and then in rapid succession they pounded on the beach until the noise was deafening. This bombardment lasted about an hour, and during all that time not a breath of air stirred. After this the Sea became quiet once more. I was lying asleep on the beach when the first breaker came in on the first night. The noise was so great that I thought a wild beast was crashing through the jungle at the mouth of the Callirrhoe, and I sprang to my feet in alarm. Sir Chas. Wilson has suggested that the phenomenon may be due to a change in atmospheric pressure, resulting in disturbances like the *seiches* on Lake Geneva. Professor Libbey told me that when he was camping at Tafileh, southeast of the Dead Sea, at about the same hour in the evening, the air suddenly commenced to rush down toward the Sea as if it were being sucked into a whirlpool. It almost threw him from his feet and nearly carried the tents away. It is not difficult to see how the vast volumes of hot air rising from the surface of the water suck the cold air down the gorges from the mountains. I found this draft of cold air one evening as I was bathing in the Callirrhoe. It rushed down with such force that I was glad to make my retreat.

I often noticed, while rowing during the day, that a heavy swell would come in toward shore and would soon be followed by others. Not a breath of air would be stirring at the time, but within fifteen minutes the wind was sure to blow. Lieut. Lynch also noticed this fact. I always sought a landing-place as soon as I felt the first swell, and pulled my boat out of danger.

The two most interesting places along the Moab shore are the points where the Callirrhoe and the Arnon enter the Sea. All the way down the coast we saw streams of hot water coming down to the Sea, their borders fringed with rank vegetation. Clinging to the cliffs at different points were palm trees that seemed to have a very precarious foothold. Bold headlands ran out into the Sea,

enclosing bays a mile or two across. But the points upon which I wish to dwell briefly are the two noted above.

The Callirrhoe has always been a famous stream by reason of the medicinal properties of its waters, which are strongly impregnated with sulphur. At the springs, high up among the cliffs, they are from 110° to 140° Fahr. At the mouth of the stream, where it is twelve feet wide and one or two deep, the water is 70°.

From the north shore of the Sea a steamer could easily run over to the Callirrhoe in a couple of hours, and a bathing establishment might be built at this point. But this is not likely to be done, since the Government does not wish improvements of this kind. Last year a neat steam launch was taken down to the Jordan; but it has never been used, as no permit has been given, and none is likely to be.

But the point of greater interest than even the Callirrhoe is the Wady Môjib (Arnon). The chasm of this stream had never been explored—not even by Lieut. Lynch. His boats were too large to pull up over the rapids, and, as the waters fill the chasm beyond, wading or swimming is impossible. Up to this time I had felt that a great mistake was made in venturing out upon this strange and treacherous Sea in a small skiff made of thin pine boards. Now I realized that the boat was just such as I needed to explore the chasm.

The cañon is a hundred feet wide and the stream forty at the point where the Dead Sea is touched. The water is clear, cool, and sweet, and then had a depth of one foot. Fishes of ten inches in length, and in great numbers, were swimming in the shallows. Four hundred and fifty feet up the chasm it turns sharply to the south, and narrows to fifteen feet. Then in a few yards it further narrows to four feet, with the water rushing down furiously. I had stripped myself of clothing, and at this point left the boat and tried to wade against the stream. This I succeeded in doing for a few feet, until I reached a point where the stream again turns toward the east. Looking around the angle, I caught sight of a waterfall, but could get no idea of its height. It must be considerable, however, as its roar can be heard on the beach. Lieut. Lynch calls attention to this sound. It was clearly impossible for me to proceed, and it is evident that to follow the Arnon down from the interior to the Sea is impossible. Professor Libbey made careful measurements of the Arnon valley some fifteen miles back, and found it to be four miles across and three thousand five hundred feet deep.

During my explorations on this coast I was constantly impressed by the fact that if one were shipwrecked between the Callirrhoe and the Arnon it would be very difficult, if not absolutely impossible, to climb to the Moab tableland.

The beauty of the Arnon cliffs can scarcely be exaggerated. The sandstone is a dark, rich red, and curiously carved by the storms of centuries. Indeed, all along this coast the variety of colours in the strata is striking and the hues are gorgeous. They will compare favourably with the magnificence of Petra. Then, as one pushes out upon the Sea and gets a glimpse of the ranges beyond the grandeur of it all is most impressive.

My return to the Jordan brought me face to face with the dangers encountered by previous explorers. A storm came up before we left the Arnon, and raged with great fury for twelve days. I found that the wind generally died down at about one o'clock in the morning, and did not come up again until four. But the waves were always higher than our boat was really able to meet. But provisions were low, we had no tent, and the dark clouds over the Judean hills threatened rain. We took advantage of these hours of comparative calm and ventured out into the darkness. Often the wind unexpectedly increased, and we were obliged to seek a landing-place. This was difficult in the darkness and with the waves coming back in counter-seas from the cliffs. When, at last, almost in despair, we came to a little beach the men jumped overboard in time to save our boat from the rocks, and I threw our baggage ashore, not forgetting to carry carefully our tin of fresh water. On this beach we slept as the storm raged during the day, and at night made as much progress as possible toward the north shore.

Our hands and faces were cracked and sore. The intensely salt water, with oil and sulphur, to say nothing of the many other ingredients contained in it, caused these sores to smart and burn. Our clothing was stiff and greasy, and our shoes were falling apart. We longed for Jericho!

One morning at four the waves threw us upon the beach at the north end of the Sea, but east of the mouth of the Jordan. We crawled behind some bushes to escape the fury of the storm. Soon the rain came down in torrents and the black clouds promised nothing good. The men went out in search of a Bedouin camp, and returned with a camel and half a dozen Arabs. Boat and baggage were strapped on the camel's back, and off we went to the encampment.

The storm continued for two days and nights more, and during that time I had many experiences with these sons of Ishmael.

The facts I have briefly indicated give some idea of the problems yet to be solved and the need of a scientific expedition with full equipment of modern instruments. Commercially the wealth of oil, bitumen, and salt along the shores of the Sea is doubtless great. At only a few points is the odour of sulphuretted

hydrogen too strong for enjoyment; therefore, as a health resort many parts of the coast might be advantageously exploited. To bathe in the warm waters of the Callirrhoe and then swim out upon the surface of the Sea and float lightly on those waters is an experience most pleasant.

In conclusion, I can but repeat what I have said elsewhere. "The Dead Sea is no respecter of persons, and has served all explorers alike. It is as strange and mysterious as ever. Mr. Gray Hill warns against all attempts to venture out upon it unless one has a staunch vessel. I repeat the warning. The Sea may appear fair and inviting to the tourist who lingers but a few minutes on the north shore; but, beware!"

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## THE DEVELOPMENT OF CUT-OFF MEANDERS.

BY

W. S. TOWER.

*Purpose.*—The following article represents a part of a year's work in physiography under the direction of Professor W. M. Davis, to whom the author owes much for helpful suggestions and criticism.

The object of the article is to describe and explain, as completely as possible, the essential features of successive stages in the development of a cut-off meander. In the course of the work both inductive and deductive methods have been found useful.

The order of procedure has been, first, to deduce the normal order of river changes in an ideal case. Then these expected changes have been confronted with the facts of observation. The two methods of investigation have been necessarily more or less concomitant. A systematic study of the Preliminary Maps of the Mississippi River and the Annual Reports of the Mississippi River Commission from 1880 to 1902 has been the main source of observed facts.

*Definitions.*—The definition of certain terms is made necessary by the general lack of satisfactory definitions both in text-books and in books of reference. Hence, to insure a clear understanding of their subsequent use, they are here given at the outset.

*Meandering*, a characteristic habit of mature rivers, may be defined as winding freely on a broad flood-plain, in rather regular river-developed curves. Under special conditions meanders may occur on plains not essentially river-made—that is, not flood-plains or incised below their original level.

*A meander*, a characteristic feature of a river that has reached maturity, is one of a series of regular curves, alternating right and

left along the river course. In Fig. 1 the curves A, B, D represent a series of meanders, free from many of the accidental irregularities of actual cases. Such curves are developed and controlled by the normal river process of cutting on the outer and down-valley bank and filling on the inner and up-valley bank of every turn. Each meander curve encloses a piece of land which may be called the lobe, L, L. These lobes are usually joined to the mainland by a narrow strip or neck, N, N. As its development progresses, the meander gradually enlarges, first the arc, and later the radius of curvature, and slowly advances down valley. From maturity of the river to old age, however, the meanders of any given part of the course are of successively different qualities; for, as the river grows older, it develops meanders of smaller radius and larger arc. At the same time the rate of down-valley migration of the meanders steadily diminishes. When, in this migration and enlargement two curves coalesce, a cut-off occurs, Fig. 1, H.

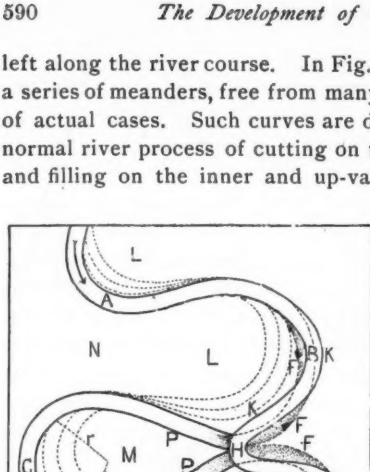


FIG. 1.
RIVER MEANDERS: YOUNG STAGE OF CUT-OFF.

*Incised meanders.*—The course of a river normally developed to maturity on a flood-plain may, by virtue of relative uplift of the land, be cut down below its original level and flow in a narrow valley. In this case the river meanders are said to be entrenched or incised. During the process of entrenchment, and before the river has again reached grade, the lateral cutting gives rise to steep slopes on the outer and down-valley sides of the curves, where the current is undercutting; and long, gentle slopes on the inner and up-valley sides of the curves, where the river is sliding off or withdrawing. At the same time the size of the meanders and the width of the meander belt are increased. When the river again reaches grade the development of the meanders follows essentially the same rules as before uplift occurred. The arm of the upland, now enclosed by each meander, may be called a spur, not a lobe. It is like the lobe

usually connected with the upland by a narrow neck. Incised meanders, however, are dependent for their occurrence on two cycles, and are not further considered in this article.

From this general definition a short definition may be evolved, by pruning and condensing, as follows: A meander is one of a series of regular curves, alternating right and left, developed by a mature river. In successive stages of development each meander enlarges and advances down stream.

The *radius* of curvature is the average of all the radii of the meander curve; in Fig. 1, r, r represent separate radii.

The *arc* of curvature is the length of the meander curve measured in degrees, Fig. 1, P, P.

A *cut-off* is the shorter path which a river follows in virtue of having cut through the neck of a lobe or spur, Fig. 1, H.

The *thread* of the fastest-flowing current is the locus of the fastest-flowing particles, and does not necessarily represent the continuous path followed by a single water particle.

The meander *belt* is the area enclosed between tangents to the outer curves on both sides of the stream.

*Growth of meanders.*—As a preliminary step to the consideration of cut-offs, let us see how the changes and growth of a meander are brought about. The general laws governing the formation of river meanders have been stated as follows: *

> The most important process in the development of river meanders is the displacement of the line of fastest current by inertia from mid-channel toward the outside of every curve. As a result, erosion tends to take place on the outside, and deposition on the inside of every curve. However slight the initial bends they will be increased, and as the valley floor is broadened the curves will be developed into systematic meanders of increasing radius and breadth . . . A river not only tends to increase its meanders; it also tends to push the whole meander system down the valley. This is because the line of fastest current, displaced towards the outside of every curve, enters the succeeding curve (or stretch between two curves) near the down-valley bank, which is therefore worn away, while the opposite up-valley bank is built out.

*Effect of Gradient.*—The amount of displacement of the thread of fastest current which controls lateral erosion is determined by (1) the strength of curvature of the turn, and (2) the mass and velocity of the river. Cutting and filling of the banks should be equal in amount, and should vary directly with the amount of displacement, though not necessarily in the same ratio. Other things being equal, then, a steeper, and hence swifter, river should show the

* Prof. W. M. Davis; River Meanders, p. 146, Geol. Mag., Dec. IV, Vol. X, 1903, 145–148.

most lateral cutting and the greatest development of meanders. But that is not the case. Not only the fact of cutting, but also the place of cutting, must be considered. The greater the velocity of a river, the longer will it take for any curve to cause maximum displacement of the current and the farther down stream from the beginning of the curve will maximum cutting occur. Hence, the curves of a stream on a steep gradient will enlarge slowly, but will rapidly advance down valley (Fig. 2, curve A). The curves of a less rapid stream will enlarge steadily, and slowly move down valley, Fig 2, curve B. In any given stream, then, the gentle turns and bends along the steeper initial course will, without much change of character, progress rapidly down valley. On the gentler slopes of the later stages, curves of more and more symmetrical form will be developed and their down-valley migration will diminish. A river of great extent may show, in different parts of its course, all phases of meander growth at the same time. In the well-graded lower courses the best-developed meanders would be expected, with a gradual transition toward the head-waters to the simpler conditions of youth.

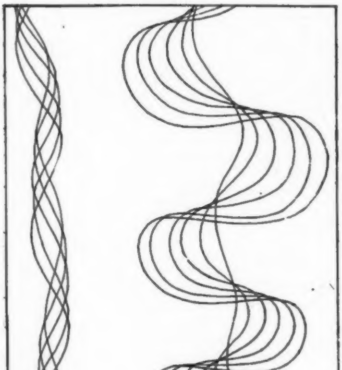


Fig. 2.
DEVELOPMENT OF MEANDERS IN RIVERS OF STEEP AND OF GENTLE GRADIENTS.

*Formation of a Cut-off.*—The growth of a single meander on a mature river includes all the stages from an initial bend to the closed curve of the mature river. The first visible change expected is an increase in the arc of curvature, followed by a lengthening of the radius. When the continued action of enlargement and down-valley migration causes two curves to coalesce a cut-off occurs.

*Changes following a Cut-off—Rapids.*—The first result of a cut-off will be to afford the river a new, shorter course, in which the gradient is much steeper than elsewhere. This will cause at least a part of the stream to turn through the new course and form rapids.

Its ability to maintain a graded course, however, enables the river to distribute the steeper slope up and down stream, and the rapids will quickly disappear.

*Change of Current.*—The position of the fastest-flowing current, previous to cut-off, is near the outer bank of the curve on both sides of the neck. When the neck is cut through, the movement of part of the current through the cut-off must shift these positions. Following the steeper slope, the current on the up-valley side of the neck must turn more and more through the cut-off, enlarging the breach, and more or less completely abandoning its former course round the meander curve. At the same time, the entrance of the cross-current will crowd away the current on the down-valley side of the neck from its former position, forcing it toward the lobe of the next down-stream meander.

*Change of Banks.*—Any change in the position of the current destroys the previous condition of balance between current and bank. Changes in the banks must therefore result; places where cutting was formerly going on may now be filling; and banks recently built may now be eaten away. The crowding of the current toward the down-stream lobe causes erosion of the bank. The place where such erosion occurs may be called a *nip*. Fig. 1 shows an early stage in which a cut-off has occurred, at H, with the formation of nips at K K, the dotted line indicating the former position of the bank. The withdrawal of the current from the outer side of the curve leaves that bank bordered by quiet water, in which deposition will probably result. Such deposition may be called a *fill*, Fig. 1, F F. Fills may or may not be continuous with the former banks; for the sudden change of the current may, on the first fill down valley from the neck, cause deposition away from the bank, and separated from it by a narrow strip of water or slough.

During these changes in current and banks down stream from the cut-off similar changes will occur up stream. By virtue of the rush of a current through the cut-off, water is drawn from the neighbouring up-stream parts of the river. To supply the current caused by this withdrawal, there is a rapid inflow from adjoining parts of the stream, which tends to shift the line of fastest current away from the outer bank. The changes due to this shifting are similar to the changes below the neck. Here, as there, nips are formed where deposition was formerly going on, and fills are made where active cutting occurred before.

*Arrangement of Nips and Fills.*—A new series of lateral swings

of the current is soon developed, and, from their extension and continued action, a systematic pattern of nips and fills should result. Nips and fills should occur both up stream and down stream from the cut-off—possibly more evident down stream than up stream—alternating from side to side along the river's course. The initial fills form on either side of the cut-off neck; the initial nips opposite them. Other nips and fills of rapidly-decreasing strength should occur indefinitely up and down the stream.

*New Meander.*—In the course of these changes all the flow of water round the old meander will cease. It then becomes a dead-water area. The ends of the deserted curve favour the deposition of silt, and soon fill up, and an "ox-bow lake" results. In a late stage after cut-off, the river will reach the conditions shown in Fig. 3. The nips, K K, and fills, F F, increase in size and extent farther up and down stream, while the original swing of the current round the remnant of the cut-off neck results in the birth of a new meander, A, somewhat down stream from the cut-off.

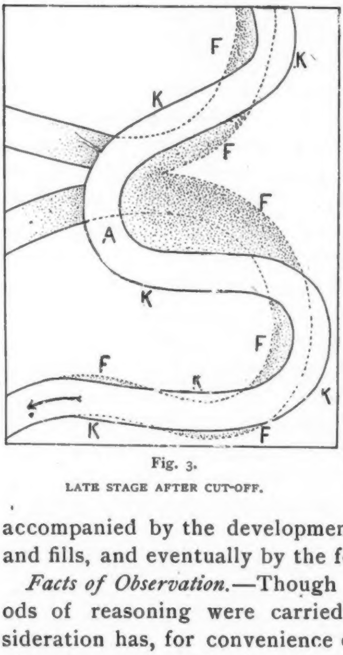


Fig. 3.
LATE STAGE AFTER CUT-OFF.

*Summary.*—Briefly, then, the expected results of a cut-off are certain definite changes in the position of the current both above and below the neck. These changes of current are accompanied by the development of a systematic pattern of nips and fills, and eventually by the formation of a new meander.

*Facts of Observation.*—Though inductive and deductive methods of reasoning were carried on together, the inductive consideration has, for convenience of presentation, been placed here after the purely deductive side. The main source of observed facts has been from a study of the Preliminary Maps of the Mississippi River—thirty-two in number—which cover the river from Cairo, Illinois, to the Gulf. The surveys of 1883, in black, and the re-surveys of 1895–96 in red overprint, afford an excellent opportunity to study river changes from careful records. The discussion of the facts of occurrence, the conclusions to be drawn from them,

and a comparison with deduced results form the latter part of the article.

*Deflection of Current.*—The position of the thread of fastest current is not shown on the maps. The location of the main channel is given, however, and, indicating greatest depth, has been considered as indicating the position of the fastest current. In every case the main channel, and hence the current, shows the well-known displacement toward the outer bank of the curve; its closeness to the bank depending upon the strength of curvature of the particular turn. On some of the most perfect meanders, as on Rowdy Bend, above Greenville, Miss., maximum displacement brings the channel within a few hundred feet of the bank, or about one-eighth of the width of the stream at that point.

*Cutting and Filling.*—Displacement of the current has caused in every case some erosion of the banks where they are unprotected by revetments. Perhaps the most striking example of this is seen at Raleigh Landing, about fifteen miles above Vicksburg, Miss., which in twelve years was forced back over a mile. Less marked examples occur at many other points along the river, among which may be mentioned Rivers, Avalanche, Lee's and Ship Bayou landings, near Natchez, Miss., all of which were moved back half a mile or more. As was expected, the erosion of one bank is accompanied by filling along the other, so that the width of the river remains fairly constant. Out of the twenty cases in which a marked amount of both cutting and filling was measured, more than half showed the two processes to be practically equal in effect. In a few cases the amount of filling fell below the amount of cutting. For the most part, however, where the two processes differed at all, the amount of filling was greater than the amount of cutting. In looking for an explanation of this unexpected condition, it appeared from the maps that the greatest excess of filling over cutting occurred on bends of strong curvature. Furthermore, in many of the best-developed meanders, as at Greenville, Miss., above Arkansas City, Ark., and again at Raleigh Landing, there is a fairly distinct excess of filling on the outer or stronger part of the curve. It seems probable that the stronger the curve, the greater the displacement of the current, the more sluggish the water along the inner bank, and the greater the amount of deposition—even to an actual narrowing of the stream. Conversely, we ought to expect the river to be the widest in the reaches and on the gentle curves—a condition which, though modified in many cases by local conditions, holds true in general.

*Rate of Cutting.*—The rate of lateral cutting depends on the amount of deflection, as shown by comparing a strong and a gentle curve. Two such curves are shown just below Natchez, Miss., at Esperance Point, and at Dead Man's Bend. Both have about the same arc of curvature. The former has a radius of less than one and one-half miles; the latter is much longer, and has a radius more than twice as great. The first, therefore, is much the stronger curve, and shows a maximum cutting of over half a mile; while the second shows hardly more than one-eighth of a mile in the interval of twelve years between the surveys.

*Down-Valley Migration.*—In passing from one curve to another of reversed direction, the current, as indicated by the position of the channel, is seen to enter the second curve flowing nearer the inner or the down-valley bank. In many cases this has resulted in giving the maximum amount of cutting on the down-valley bank, which, together with the filling on the opposite bank, causes a distinct movement of every meander down valley. On all of the curves, as at Raleigh Landing, at Esperance Point, Louisiana Bend, etc., the down-valley migration is shown to a greater or less degree. The amount of migration, however, seems to vary. In general, it may be said, that in early stages of meander growth there appears to be a more rapid down-valley migration, and that with an increasing arc of curvature migration decreases.

Thus, the observed facts bear out all the deduced conditions of river change previous to cut-off. It remains only to test in the same way the expected conditions subsequent to cut-off.

*Changes Subsequent to Cut-off.*—Following the general laws of river action, certain results were expected from the formation of a cut-off—namely, the existence of temporary rapids; the displacement of the fastest-flowing current on both sides of the cut-off, destroying the condition of equilibrium between current and bank; the development of a systematic pattern of nips and fills; and, finally, the growth of a new meander a little way down stream from the older one.

*Rapids and Changes of Current.*—Some of these deduced results, such as the existence of rapids, cannot be proved from the study of maps, but their occurrence has been noted by observers near at hand at the actual moment of cut-off. Furthermore, the maps show numerous examples of different stages in the shifting of the current after cut-off; but, for the most part, they are rather late stages, and do not give the early changes of the current. It is not unreasonable to suppose, however, that the later stages shown on

the maps, and which fall into the deduced scheme, are reached, not suddenly, but by a series of systematic stages, each of which will itself fall into the scheme.

*Nips and Fills.*—The conditions at Davis's cut-off, just south of Vicksburg, Miss.—sheet 18—show a rather advanced stage after cut-off, which suffices to show how closely the actual resembles the late stage of the ideal case, as shown in Fig. 3. The principal difference is that the initial nip and its associated fill up stream from the cut-off have been obliterated by the normal down-stream migration of the river curves. A much earlier stage is shown by the comparatively recent cut-off at Coles Point,* where a condition closely analogous to Fig. 1 is shown. It also shows the down-stream fill from the cut-off as a distinct island, with a slough behind it, indicating a rapid change in position of the current.

*Arrangement of Nips and Fills.*—At Davis's cut-off the alternating arrangement of nips and fills, both up and down stream from the cut-off, is apparent, with some indication, also, that the nips are larger down stream than up stream. In both directions from the cut-off the size of the nips and fills rapidly diminishes. For example, the first down-stream fill shows a maximum width of over 2½ miles, the second is less than one-third that width, and the third is still smaller, beyond which they rapidly diminish until they quickly cease to appear. Theoretically they should extend, with decreasing effect, indefinitely in both directions. In the actual cases the decrease is so rapid that it soon becomes impossible to draw any line between the special effects due to cut-off and the normal action of the river.

*Number of Nips and Fills.*—A count of the nips and fills associated with fifteen cut-offs showed them in every case to be equal in number; that is, for every nip there was an associated fill. Up stream from the cut-off the minimum number of nips and fills was 1 of each, the maximum number 3, with an average in the fifteen cases between 1 and 2. Down stream from the cut-off the minimum was again 1, the maximum 5, with an average of 3. The figures in each case apply only to those changes in the banks which were distinctly due to cut-off.

*Formation of New Meander.*—In early stages after cut-off the river-ends of the old meander become silted up, with the formation of a so-called "ox-bow" lake. One of the largest cut-off meanders is the one already mentioned at Davis's cut-off, Palmyra

* See Fig. 7 in an essay by R. M. Brown, "Mississippi River from Cape Girardeau to the Head of the Passes," Bull. Am. Geog. Soc., Dec. 1903. Vol.

Lake; other examples may be seen at many points along the course of the river. At the same time with the silting up the acute end of the neck of the lobe may be nipped and blunted by the outward cutting of the current. In most cases, however, this outward cutting does not proceed precisely in the direction of the former meander, for the habit of all curves to move down valley gradually carries the new curve away from the immediate vicinity of the cut-off lobe. This is particularly well shown at Davis's cut-off, where a well-developed curve already exists. With but a single exception, every case so far observed shows the formation of a new meander in some stage of development down valley from the cut-off.

It has been reported recently that the down-valley migration of the curve above Sargent's Point, below Vicksburg, has allowed the river to cut through the neck and return to its former course, long known as Lake Palmyra. By this change several cotton plantations were practically ruined, Davis Island was restored to the Mississippi mainland, and further growth of the meander below Davis's cut-off was probably stopped.

*Application to Mexican Boundary Question.*—The importance of clearly recognizing these processes of river change in meander growth and in the formation of cut-offs is shown by the recent report on the "Proceedings of the International (water) Boundary Commission United States–Mexico" [Washington, 1903, 2 vols.]. In 1852 a treaty between the two countries placed the boundary in the middle of the channel of the Rio Grande River, which, below Rio Grande City, meanders very freely, and also, during flood-time, often changes its course abruptly. To avoid complications that might arise from such changes in the channel, it was stipulated that the boundary should continue to follow the channel of the river, provided that alterations in the course "be affected by natural causes through the slow and gradual erosion and deposit of alluvium." In all other changes, sudden or artificial, the boundary should follow the original channel at the time of making the treaty. According to the treaty, normal cutting and filling on meander curves was interpreted, no matter how great in amount, to be a slow and gradual change. The boundary, therefore, migrated with the river, and what one State lost by erosion was added to the other by filling. For example, nearly half the city of El Paso is located on land built by the river and added to Texas since 1850.

Cut-offs, on the other hand, the ultimate result of "slow and gradual erosion," were considered to be sudden or "avulsive"

changes, the results of caprice on the part of the river, and, therefore, the boundary remained in the middle of the former channel.

It is estimated that fifty cut-offs have occurred since the treaty was made, leaving the cut-off lobes, or *bancos*, as they are locally known, on the opposite side of the river from the country to which they belong. In some cases the bancos are left entirely shut off from the river and surrounded by domain and people under a different Government. Under these conditions, to quote from the U. S. Commissioner,

> it will be easy to see that the laws, local, state, and federal, will be administered only under great difficulty. The products of the bancos could not be sold to citizens of the country in which the banco is located without violating the revenue laws, nor transported for sale to the country to which the banco belongs without violating similar laws. The violators of the laws of the country to which the banco belongs could not be arrested and conveyed to the country having jurisdiction without special extradition laws.

In 1893 a dispute arose over the Banco de Vela. Citizens of both countries were arrested and imprisoned; troops were sent to the vicinity, and both countries threatened to seize the island. A joint commission was appointed to settle the questions in dispute. As the simplest remedy for the difficulties, the Commission suggests that a banco be no longer considered as due to "avulsive" change, and that arrangements be made for the transfer of jurisdiction to the country in which it is located, provision being made for the transfer of titles to land and for the inhabitants, if there be any, to retain their former citizenship if they choose.

*Summary.*—From the foregoing discussion and illustrations it appears that the development of river meanders is an endless sequence, the importance of which must be recognized in making any river the boundary of a State or country. From initial bends and turns the river produces, by constant, well-defined processes, a systematic pattern of meanders. The meanders in their development pass through a series of stages which follow a regular scheme except as interrupted in times of flood by sudden changes known as short-cuts. The final stage of the growth of a meander, the stage of cut-off, leaves the river with a new bend, from which the process may be repeated. There may, therefore, be in one part of a mature river all stages of meander growth at one time.

# AN ANCIENT MAP OF THE WORLD.

In the old European maps of the world we find that, starting from some well-known centre and branching out toward the four points of the compass, the details become less and less definite, until at last the cartographer was compelled by the lack of definite knowledge to draw heavily upon his imagination, and peopled the distant seas with all sorts of grotesque conceits. The imagination abhors a vacuum, and, so long as no rational explanation of a phenomenon is forthcoming, man is forced to supply the void from the fertile realms of fancy.

That human nature is the same the world over is shown by the accompanying map of the wórld as conceived by the Chinese and Korean mind. The only difference between this map and those of the Middle Ages in Europe is one of degree. The Oriental has allowed himself to draw more heavily upon his imagination than the Occidental dared to do. As Italy was the geographical centre of the world as known to the Occident, so China, the "Middle Kingdom," was the centre of all things to the denizen of the Far East.

It will be noticed that the centre of the map contains a single continent; that this is surrounded by a sea filled with island kingdoms; that this, again, is surrounded by land in the shape of a ring, and that about the whole flows the great ocean, which, according to the cartographer, is represented (150) as an "endless sea." The map is complete, and nothing is conceded as being unknown. It was not deemed wise to allow the public to suspect that there was any land that the cartographer did not know.

It appears that this central continent represents Asia alone, India being at the southwest corner. The only rivers definitely given are the Yellow River, the Yang-tse, and the Mekong, all of which are represented fairly well. The general course of each of these is approximately as given here. It is interesting to note that China proper is represented as lying between the Yellow River and the Yang-tse, which, as history proves, was the real birthplace of the Chinese people. Korea and the Yellow Sea are also well represented, but when we go farther afield than this we find confusion at once. Annam is not far out of the way; but the land to the west of it, which must represent Siam and Burmah, is highly fanciful. The water to the east of India must be the Bay of

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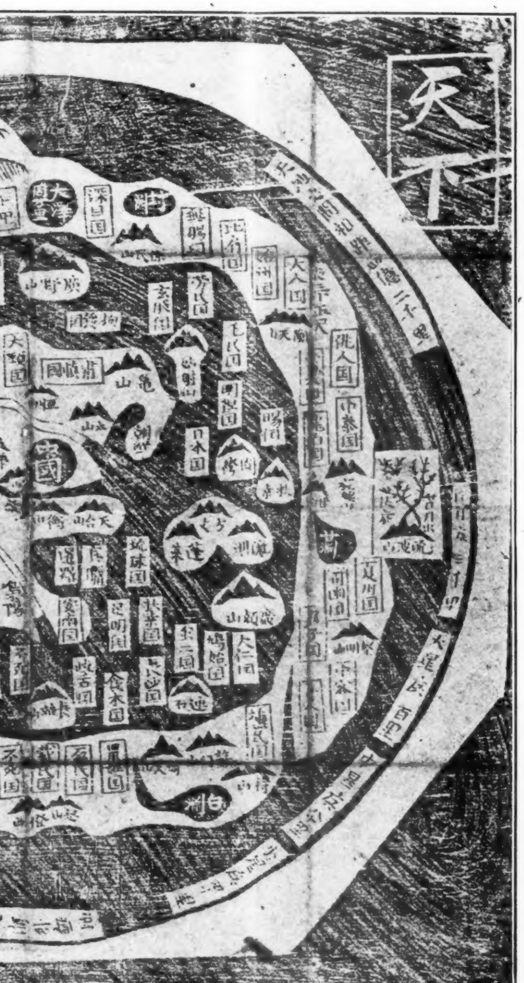
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Bengal, and the two forks at the head of it may represent the Irrawaddi and Salween Rivers. If this is so, the Kwen-lun Mountains (123) are not far enough out of their proper place to call for severe criticism. The unnamed lake to the north of these mountains may be the Caspian Sea, by a stretch of the imagination.

We note that the name of the map is put at the two upper corners, and means (146) "Under the Heavens" and (147) "The Whole Map." Around the edge are arranged some statements of a general nature—namely, that the distance around the world is some thirty million miles; that the world contains eighty-four thousand different countries; that it is surrounded by a limitless ocean; that the stars vary in width from twelve to thirty miles; that the sun and moon are nine hundred miles wide, and that the heavens and the earth are separated by a distance of 120,000,600 miles (English). The definiteness implied in the last 600 miles is conclusive as to the accuracy of the figures!

It is not necessary to go over the whole map and mention each land in particular, but there are certain ones that demand a word of comment. In the far north we find, for instance, the "Covered Lake" (4). This might well refer to the great ice-covered Arctic Ocean; and the "Land Without Sunshine" (6) is not a bad description of the sub-Arctic winter. The "Land where Political Divisions were First Made" is a pretty conceit (8), but we wonder that the Chinaman should have conceded the invention of that contrivance to another people. If we were to attempt a comparison between these names and those of European myth and legend we should say that this corresponds in a melancholy manner with the story of Pandora and her box.

One of the most important of these names is that of Pusang (17), to the extreme right of the map. In Korean and Chinese legend this land lay 70,000 *li*, or 21,000 miles, to the east of China. In that country grew enormous trees, 400 feet in height. Some people think this refers to America; and it certainly matches the facts very well. The distance is exaggerated, but the fact that it lies far to the east, and that it grows such phenomenal trees, would indicate that the land mentioned is the Pacific coast of America; but it will be noted that there are two other places named Pusang as well (67) and (76), so that it appears that the Chinese were in the dark as to its exact location. Somewhat north of this Pusang lies "Heaven Balance Mountain" (10), which reminds us forcibly of the tale of Atlas. If we might give reins to fancy, we could easily conceive that the "Land of Superior Men" (22) referred to the Aztec

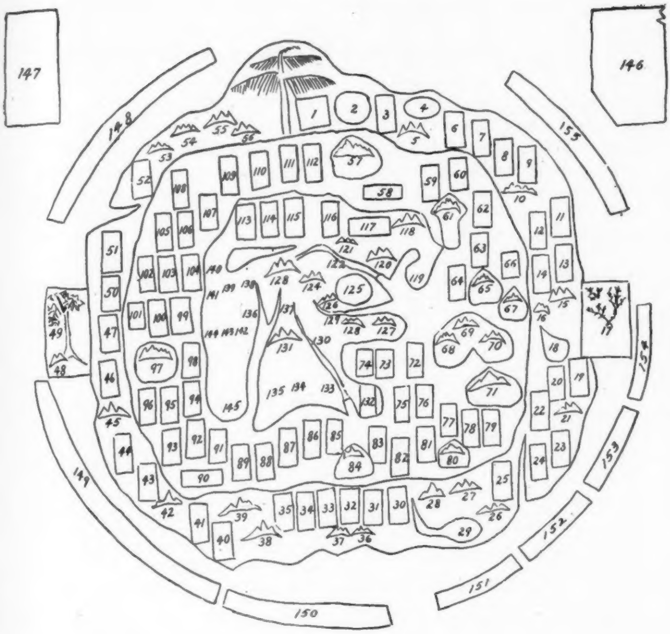
civilization, which may have been in its zenith at the time this map was made. In the "Land of Women" (24) we find a counterpart to the Amazons of our Western mythology.

Passing around to the south, we come to the "Land where People do not Die" (33), evidently the Sheol, Happy Hunting-grounds, Valhalla of the West. The "Land where People have Animals' Heads" (35) is a Brobdingnagian conceit, as also is the "Land of Giants" (9). In the far west we find the "Cloud-governed Land" (46). Surely this cannot mean England. And yet how apposite!

Passing around to the northeast, again, we find the "Land of Hairy People." This may possibly refer to the Ainus. If 64 represents the southern island of Japan, and 68 the middle island, then 62 might easily stand for the Hokkaido or North Island, where the Ainus live. The land numbered 65 is right beside Japan, and is called "Land of Asking Trousers," but we would hardly dare say that this refers to the fact that this useful garment has, until lately, not been in common use in Japan. "Glass Bead Land" or Loo-choo Islands seems to lie too far away from Japan; and we can make nothing of the large island containing 68, 69, and 70, which seems to lie partly between Japan and Loo-choo. Siam is mistakenly made an island, and is placed (74) north of Annam. "The Land where Wood is Eaten" (82) may refer to the fact that so many of the people in Polynesia live on fruits almost exclusively. The "Land of Fire-haters" (89) lying near the Equator, is well named, though it is hard to recognize it as any existing people.

Passing toward the west, we find the four contiguous peoples called respectively "Extraordinary Land," "Land of Good Agriculture," "Land of Musical People" and "Land of Vain People." These are about where Europe ought to be, and whether the names are apposite the reader must judge for himself. Norway might be called the "Deep Sun Land" (106), as the sun does not rise high in the heavens even in summer.

But, seriously, it is impossible to verify more than a few of the places on this map. From a genuinely geographical standpoint it is worthless, but to the student of folk-lore it opens a wide field of study. All these places and peoples are mentioned in one place or another in Chinese and Korean literature, and the time may come when it will be possible to verify a large number of the names. At any rate, this map should be preserved for purposes of reference when the great subject of Chinese lore is thoroughly opened up.



## INDEX TO THE MAP.

1 The Tree that Shades a thousand *li* (300 miles).
2 The Lake a thousand *li* around (300 miles).
3 Land of People with Deep-set Eyes.
4 The Covered Lake.
5 The Mountain of Man's Origin.
6 The Land Without Sunshine.
7 The Land of Shoulder Comparison.
8 The Land where Political Divisions were Invented.
9 The Land of Giants.
10 The Heaven Balance Mountain.
11 The Land of Light Men.
12 The Land of Little Sky.
13 The Medium Land (Middle-great country).
14 Land of the Elder Dragon.
15 Mountain of the Shaking Aspen.
16 Sweet Mountain.
17 Pusang (Mulberry-holder) Place of Sun- and Moon-rise.
18 Sweet Lake.
19 The Land of Summer.
20 The Lowly Land.
21 Mountain of Bright Valleys.
22 The Land of Superior Men.
23 The Middle-face Land (Men with faces in their breasts).
24 Land of Women.
25 Land of Black People.
26 Mountain of Waiting.
27 Medicine-gate Mountain (synonym for "far").
28 White Lake.
29 (Wanting.)
30 Land of Rat's Name.
31 Land Full of People.
32 Land of Loading People (Place for dumping surplus population).

33 The Land where People do not Die.
34 Land where it is Hard to Live.
35 Land of People with Animals' Heads.
36 Angry Mountain.
37 Ascending Mountain.
38 Heaven Plateau Mountain.
39 Lump of Earth Mountain.
40 Land Civilized by the First Emperor of China.
41 Land of Border People.
42 Mountain of Fire Spirits (who control all fire).
43 Bean-man Land (small and round as beans).
44 Volcano Land.
45 Great Famine Mountain.
46 Cloud-governed Land.
47 Woman's Land (The Umbrella Pine).
48 Corner Mountain.
49 Land of Sun and Moon Setting.
50 The Land of Carts.
51 Land of Linen.
52 Land of Polite Women.
53 Great Circumference Mountain.
54 Mountain of the Classics.
55 All-white Mountain.
56 Sentence Mountain.
57 Mountain of the Great Field.
58 Land of Satisfaction.
59 The Land of North Flight.
60 The Land of Troubled People.
61 Shooting Yet Mountain.
62 The Land of Hairy People.
63 Bright Level Land.
64 Japan (birthplace of the sun).
65 Mountain of Asking Trousers.
66 Sunrise Land.
67 Pusang.
68 The Land where Canonized Spirits Play.
69 Great Corner Mountain.
70 Mountain Beside the Water.
71 Broad Brow Mountain.
72 Loo-choo Islands (Glass Bead Land).
73 True December Mountain.
74 Siam (Fine Silk Land).
75 Bright Foot Land.
76 Pusang.
77 Double Gold Land.
78 Land of Pigeons' Origin.
79 The Land of Good Men.
80 Twin Boulder Mountain.
81 Long Sandy Land.
82 Land where Wood is Eaten.
83 Land of the Tongue Mountain.
84 Far Distant Land.
85 Land of Immortality.
86 Land of Cross-legged People.
87 Land of Long-armed People.
88 Land of People with Pierced Breasts.
89 Land of Fire Haters.
90 Land of Breast-joined People.
91 Transportation Land.
92 Land of Three-headed People.
93 Arm Land.
94 Uninteresting Land.
95 Three Spirit Land.
96 Extraordinary Land.
97 Land of Good Agriculture.
98 Land of Musical People.
99 Land of Vain People.
100 Land of Abject People.
101 Land of Monkish People.
102 Land of Sorceresses.
103 Land of Pears.
104 One Day Land.
105 Land without Leisure.
106 Deep Sun Land.
107 Land of White People.
108 Money-bag Land.
109 Land of People without Bowels.
110 Tangled String Land.
111 Land of Story-tellers.
112 Wide Father Land.
113 Great Mountain Pass Land.
114 Land of Playing Spirits.
115 Red-legged People's Land.
116 Great Neck Land.
117 Suk-sin Tribe (anciently in northern Korea).
118 Tortoise Mountain.
119 Korea (Chösun) "Morning Freshness."
120 Great Mountain.
121 Everlasting Mountain.
122 Yellow River.
123 Kuen-lun Mountains.
124 Bright Mountain.
125 China. "Middle Kingdom."
126 Dot Mountain.
127 Heaven Star Mountain.

128 Middle Mountain.
129 The River (Yangtse).
130 Red River (Mekong).
131 Three Emperors' Mountain.
132 Annam.
133 Owl Light Land.
134 Border Guard Wild Tribe.
135 Twelve Lands.
136 Ocean Water.
137 Black Water.
138 Far Bridle Town.
139 Middle Sand.
140 Cart Teacher.
141 Good Sewing.
142 A Wild Tribe (Wulchi).
143 The Crow's Grandson.
144 Great Land.
145 India.
146 Under Heaven (The World).
147 The Whole Map.
148 The distance around the world is 100,035,000 *li*, or 30,010,500 miles (English).
149 In all the four quarters of the earth there are 84,000 lands.
150 Surrounding these lands there is an endless sea.
151 Small stars are forty *li* wide (twelve miles).
152 Medium stars are eighty *li* wide (twenty-four miles).
153 Great stars are 100 *li* wide (thirty miles).
154 The sun and moon are each 3,000 *li* wide (900 miles).
155 Between heaven and earth the distance is 400,002,000 *li* (equivalent to 120,000,600 miles).

SEUL, KOREA. H. B. HULBERT.

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## RECENT PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

### WATER SUPPLY AND IRRIGATION PAPERS.

No. 89 deals with the water resources of Salinas Valley in California, the author being Mr. Homer Hamlin. No. 90, by J. E. Todd and C. M. Hall, describes the geology and water resources of the lower James River Valley, South Dakota.

No. 91. *The Natural Features and Economic Development of the Sandusky, Maumee, Muskingum, and Miami Drainage Areas in Ohio, by Benjamin H. Flynn and Margaret S. Flynn, 130 pp.* Mr. F. H. Newell, in transmitting this paper for publication, calls attention to the special interest of such parts of this report as describe the history of water powers, their relation to the canals of Ohio, and the decline in values following upon establishment of modern methods in manufactures, trade, and transportation.

No. 93. *Proceedings of First Conference of Engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell.* This conference was held at Ogden, Utah, in September, 1903, in connection with the Eleventh Irrigation Congress. Its purpose was to secure mutual acquaintance among the engineers of the new Reclamation Service, and the discussion of problems of fresh and common interest arising in connection with this work. The history and organization of the Service are set forth in considerable

detail, and many discussions of local problems are included; also a somewhat full biographic catalogue of the personnel of the service.

No. 94. *Hydrographic Manual of the United States Geological Survey, by Edward C. Murphy and others, 76 pp.* Intended for members of the Survey and for other engineers having to do with the gauging of streams by current meters.

No. 95. *Accuracy of Stream Measurements, by E. C. Murphy.* This report gives a technical discussion of hydraulic problems, chiefly as studied by experiments in the hydraulic laboratory of Cornell University.

No. 96. *Destructive Floods in the United States in 1903, by E. C. Murphy.* This paper, like many others, illustrates the promptness with which results are offered to the public in the recent publications of the Geological Survey. We have descriptions of the Heppner flood of June 14 in Oregon, by which 200 lives and much property were lost. The storm lasted but half an hour, and the stream resumed its normal flow one hour and a half after the flood was at its height. Another destructive flood occurred June 6, in Spartansburg County, South Carolina. More than 5 inches of rain fell at Spartansburg on that date. Mills and railway property of more than $3,000,000 in value were destroyed. Most of the paper is devoted to the Kansas floods of that year, with detailed local descriptions and many views.

No. 101. *Underground Waters of Southern Louisiana, by Gilbert D. Harris and M. L. Fuller.* The latter author discusses the use of such waters for domestic supply and for rice irrigation. Within a few years the rice lands have risen from nominal values to $30 and $50 per acre. The rice wells and rice canals are shown on a coloured map, which also exhibits the timbered flood-plains of southwestern Louisiana.

No. 102. *Contributions to the Hydrology of the Eastern United States, by Myron L. Fuller.* This paper is chiefly devoted to a summary of hydrologic studies in the eastern United States in the year 1903, and to a record of miscellaneous facts in this field, gathered from localities not under special investigation. This publication also shows commendable promptness in placing before the people the results of researches by the Survey.

No. 104. *Underground Waters of Gila Valley, Arizona, by Willis T. Lee.*

## Bulletins.

No. 226. *Boundaries of the United States, and of the Several States and Territories, with an Outline of the History of All Important Changes*

*of Territory* (*Third Edition*) *by Henry Gannett, 145 pp.* Contains many outline maps, and folding map showing award of the Alaska Boundary Tribunal.

No. 228. *Analysis of Rocks from the Laboratory of the United States Geological Survey, 1880 to 1903. Tabulated by F. W. Clarke, Chief Chemist. 375 pp.* Over 5,300 analyses have been made in the laboratory at Washington, besides many at Denver and San Francisco. The rocks subjected to analysis have been described in many journals, and the object of this paper is to bring together and make available such widely-scattered data.

No. 229. *The Tin Deposits of the York Region, Alaska, by Arthur J. Collier.* Discovery of tin by United States geologists in Alaska has already been reported in these notes. This pamphlet of 61 pages is designed to aid the prospector by bringing together the known facts, and there is included a brief notice of tin mines in other parts of the world.

Nos. 230, 231, 232, 233. *Gazetteers of Delaware, Maryland, Virginia, and West Virginia, all by Henry Gannett.* In each case the introduction gives a brief summary description of the State.

PROFESSIONAL PAPERS.

No. 21. *The Geology and Ore Deposits of the Bisbee Quadrangle, Arizona, by F. L. Ransome. 168 pp. Sections, maps in pocket, and many plates.* This report is based on field work of 1902. The important ores of the district are those of copper.

No. 22. *Forest Conditions in the San Francisco Mountains Forest Reserve, Arizona, by John B. Leiberg and others. 95 pp., with map in pocket showing land classification.* The introduction describes the physiography, soil, and drainage. A detailed description of the forests follows, not omitting the usual havoc wrought by grazing and by fires: "Fires in the yellow-pine belt have marked with basal scars and sears 75 per cent. of all the trees having standard dimensions."

No. 23. *Forest Conditions in the Black Mesa Forest Reserve, Arizona, by F. G. Plummer. 62 pp.* Yellow pine is the principal timber of this Reserve; and it is refreshing to be told that fires have done little damage in this tract, on account of the small amount of underbrush and litter.

No. 24. *Zinc and Lead Deposits of Northern Arkansas, by George I. Adams and others. 118 pp.* Mr. C. W. Hayes, in his letter of transmittal, considers this as a mineral region of increasing importance. Railway facilities were to be available for its develop-

ment before the close of 1903. The district is part of the Ozark Plateau region, and is drained by the White River and its branches.

No. 25. *The Copper Deposit of the Encampment District, Wyoming, by A. C. Spencer.* The district is on the southern border of Wyoming, and is traversed by the Continental Divide. Producing mines are few, and the region is chiefly of interest for the possible results of explorations now in progress.

No. 26. *Economic Resources of the Northern Black Hills, by J. D. Irving and others. 222 pp.* The report is mainly devoted to mining details in the region west of Deadwood.

No. 27. *A Geological Reconnaissance across the Bitter Root Range and Clearwater Mountains in Montana and Idaho, by W. Lindgren.* This report treats of a little-known region of rugged mountains extending from Northwestern Montana across Northern Idaho. Here was the crossing of the Lewis and Clark expedition in the Northern Rocky Mountains. A. P. B.

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## GEOGRAPHICAL RECORD.

### AMERICA.

Travels of Charles Alexandre Lesueur in the United States.—Quatrefages said of this naturalist that he was the first among painters of natural history. The *Journal* of the Society of Americanists, of Paris, devotes its March number to an account of the *Voyages de C. A. Lesueur en Amérique*, from the pen of Dr. E. T. Hamy, and dedicates it to the learned institutions and societies of this country as a souvenir of the part taken by French explorers in the scientific conquest of this country. Probably few of our countrymen now living ever heard of this Frenchman, gifted both as a scientific observer and as a painter, who devoted his talents to natural history investigations in our country from 1815 to 1837. The study of science in America was then young, and the long labours of Lesueur in the field were a helpful and stimulating influence.

He came to America under the patronage of William Maclure of Philadelphia, who made a fortune in business, and whose enthusiastic devotion to geology, almost before it was recognized as a science, led to his being called "the Father of American Geology." Dr. Hamy tells the story of the naturalist's long wanderings here, his favourite studies leading him across the Appalachians, through the Great Lakes, over New England back to the Mississippi, and down that river to New Orleans. Notebook and pencil were always

in hand for recording his observations or making sketches, many of which were later turned into water-colours. He discovered several new genera and a considerable number of new species of fishes. Most of his scientific papers were published in the *Journal* of the Academy of Natural Sciences, Philadelphia. Dr. Hamy's monograph concludes with a bibliography of the works of Lesueur, and twelve views of the Mississippi River, drawn by him between 1828 and 1830. The handsome memoir also includes many other reproductions from Lesueur's sketches and water-colours. The Duke de Loubat defrayed the cost of publishing this tribute to the American labours of the French naturalist.

NEGROES IN THE UNITED STATES.—Bulletin 8 of the Census Bureau, a volume of 333 folio pages, contains the most detailed and exhaustive statistical analysis of the negro element in our population that has yet been made. Over two-thirds of the volume is filled with general tables deduced from the Twelfth Census. They are introduced by two summary chapters: The Negro Population (pp. 11–68), by Mr. Walter F. Wilcox; and The Negro Farmer (pp. 69–98), by Professor Du Bois. It is possible here to give only a brief summary of the leading facts presented.

The total number of our negro population, including Alaska, Hawaii and Porto Rico, is (Twelfth Census) 9,204,531, of whom 8,840,789 live in the continental United States, to which the facts in the volume are confined. Of those living in the continental United States, 89.7 per cent. are in the South Atlantic and South Central States, 31.4 per cent. living in Georgia, Mississippi, and Alabama. A map (p. 22) shows the black belt, or counties in which the total population is at least one-half negro. This belt extends through all the South Atlantic and Gulf States, from southeastern Virginia to southeastern Texas, and also occupies a wide north and south zone on both sides of the Mississippi from Tennessee to the Delta. In fifty-five counties of South Carolina, Georgia, Alabama, Mississippi, Florida, Louisiana, and Arkansas the negro population is 75 per cent. or more of the total population. The proportion of negroes is greatest in the Mississippi alluvial region, where five-eighths of the population is negro. The maximum is reached in Issaquena County, Miss., with more than fifteen negroes to each white person.

The centre of the negro population has moved since 1790 from near Petersburg, Va., 476 miles southwest to a point in Dekalb County, northeastern Alabama.

More than three-fourths of the negroes live in the country, but the

negro population of cities is increasing more than two and one-half times as fast as that of the country districts. Comparing the censuses of 1890 and 1900, negroes in the 242 southern cities increased nearly one-third faster than negroes in the country districts; and in the country districts of the South negroes increased only two-thirds as fast as the whites. Negroes constitute 6.6 per cent. of the city population, and 15 per cent. of the country population of the continental United States. Unlike the Indians and the native whites, the negroes have a slight excess of females. Half of the negroes are below 19.4 years old, the median age being four years below that of the whites. This difference is closely connected with the high birth and death rates of the negroes. Illiteracy among negroes is about seven times as common as among whites, and among southern negroes it is more than four times that among southern whites. The percentage of illiterates is 44.5, and has greatly decreased since 1890, when it was 57.1 per cent.

There are 3,992,337 negroes engaged in gainful pursuits. In agriculture old men and women help in bread-winning much more generally than is the case among the whites. The occupations of the larger number of negroes are those of agricultural labourers (1,344,125), farmers, planters and overseers (757,822), other labourers (545,935), servants and waiters (465,734), and launderers and laundresses (220,104). The number of farms operated by negroes is 746,717, containing 38,233,933 acres, or 59,741 square miles. Of these farms 21 per cent. are owned entirely, and an additional 4.2 per cent. owned in part by the farmers operating them.

Production of Coal in the United States in 1903.—According to the report of Mr. E. W. Parker, of the United States Geological Survey, the total output of the coal mines of this country in 1903 amounted to 359,421,311 short tons. This is an increase of 57,830,872 tons, or 19 per cent., over the production of 1902. The value of the coal at the mines in 1903 amounted to $506,190,733—an increase of nearly 38 per cent. as compared with the total value of coal mined in 1902. Of the total production in 1903, 74,313,919 short tons represent Pennsylvania anthracite, valued at $152,036,448. The production of bituminous coal (which includes lignite, or brown coal, semi-anthracite, semi-bituminous and cannel coal, and scattering lots of anthracite) amounted to 285,107,392 short tons, valued at $354,154,285.

List of Altitudes in Mexico and Central and South America.—Mr. Henry Gannett has compiled a list of altitudes in these countries, which is appended to the *Bulletin* of the Bureau of

American Republics for September. Brazil, Paraguay, and the Guianas are not included, and the compilation makes no pretence of being exhaustive in the other countries; but it embraces the principal mountains, table-lands, lakes, etc., of the Cordilleras, and hundreds of other altitudes throughout the Republics. The chief and the best sources of information are the extensive surveys of the Intercontinental Railway Commission, whose work included numerous determinations of altitude in the mountain regions between Mexico and Argentina, and the Argentine-Chile boundary map, based on the surveys of Argentine engineers. Other sources are of varying value, but the greater part of the altitudes given were obtained by the survey parties above mentioned.

The height assigned to Aconcagua, supposed to be the culminating point of South America, is that given by the Intercontinental Railway Commission, 23,080 feet; the height given by Güssfeldt, and long accepted, being 22,860 feet. Aconcagua should have been placed in the Argentine instead of the Chilian list of altitudes. A later measurement of Aconcagua by M. Schrader, president of the French Alpine Club, and the engineer Enrique del Castillo, is reported in the *Geographischer Anzeiger*, *Heft X:* 6,956 meters= 22,822 feet. The height of Orizaba is given, on the authority of the "Mapa de los Estados Unidos de Méjico," as 17,373 feet. Orizaba was supposed for some time in the last decade to be the highest point of North America, but, according to this list, Popocatepetl overtops it with 17,748 feet—a result obtained by taking the mean of several determinations.

## AFRICA.

British Settlement in East Africa.—At a meeting of the Royal Colonial Institute in London in March last, Mr. Herbert Samuel, M.P., who had recently visited British East Africa, said that few persons realized what a valuable possession it was becoming. British settlers are now going out in considerable numbers to take up land in the Kikuyu region to the south of Mount Kenia, where whites may live in comfort and good health in a large district situated so high above the sea that temperate influences predominate. The Mombasa *Standard*, just received, announced the arrival of fifteen farmers in one week, who left at once for the interior to take up land near Nairobi, the most important place in that region. He thought it desirable to encourage the emigration of small working farmers to that part of Africa.

THE VARIATIONS OF LEVEL OF LAKE VICTORIA.—Captain H. G. Lyons, Director-General of the Survey Department of Egypt, has made a study of the variations of level of Lake Victoria, which forms Appendix III of *A Report upon the Basin of the Upper Nile, with Proposals for the Improvement of the River*, by Sir William Garstin, Under-Secretary of State for Public Works in Egypt (Cairo, 1904. fol. Pp. 20). The object of this study was to collect existing data as to the changes of level of the lake, and to endeavour to trace from these data the oscillations of the lake during the last twenty or thirty years. Two rainy and two dry seasons make up the year in the Victoria Lake basin, the rains coinciding more or less with the equinoxes, and the dry seasons with the solstices, except that the second, or minor, rains are delayed one or two months after the autumn equinox. The rainfall records are very incomplete and unsatisfactory, but the average lake rainfall may be taken as probably less than 1,500 mm. (60 in.). The winds on the lake itself are almost exclusively on and off shore breezes, due to the presence of the water, and correspond to the land and sea breezes in the case of the ocean; but the trade-winds, with their seasonal changes, are noted away from the lake.

The variations in the level of Lake Victoria are of several kinds. First may be noted the increase or decrease in size, due to climatic or other changes extending over long periods. There is much evidence around the lake that in early times its waters stood at a higher level. Certain flat alluvial plains in the valleys above the present lake-level are believed by Scott Elliot to have been deposited in the waters of the lake, and this authority puts the upper limit of these plains at thirty meters above the present lake-level. Secondly, there are oscillations due to variations in meteorological conditions having a comparatively short period, in which a time of high levels is followed by one of lower levels, and there are the annual oscillations, due to the April and the November rains. Concerning the former oscillations, there seems to be a general agreement on the part of Europeans and natives that the lake-level has sunk recently, and particularly from 1878 to 1892, after which there was a tendency to rise. This rise appears to have been limited to the period 1892–1895, or perhaps even to the years 1892 and 1895 only, which were years of heavy rainfall. From this time the fall has been almost continuous up to the end of 1902. Generally speaking, 1850–1878 was a wet period, and 1879 to 1886 a dry one, for the whole of Central Africa. The series of gauge-readings is too short to determine the period of secular oscillation; but they

show a fall of 76 cms. (30 in.) in the average level of the lake between 1896 and 1902, since followed by a rise of 56 cms. (22 in.).

The tides of the lake have not yet been investigated with sufficient accuracy to determine their range; but *seiches* certainly occur, although no precise study of them has yet been made. It is probable that the sudden variations occasionally shown by some of the lake gauges are of the nature of *seiches;* but as there is only one station with a barometer, the subject cannot be pursued very far at present. All accounts of the lake mention the violent thunderstorms and the waterspouts and cloudbursts which occur there; hence it is not surprising that the gauges occasionally show irregularities.

R. DeC. W.

Progress in Katanga.—Mr. E. Tonneau, the Administrator of Katanga, in the southeastern part of the Congo Independent State, has a long article on that territory in the Aug.-Sept. number of the *Bulletin de la Société d'Études Coloniales.* In few parts of Africa is pioneer work more energetically pushed.

Katanga embraces practically all that part of the Congo State lying south of 5° S. Lat. and east of 27° 54′ E. Long. In other words, it includes most of the Upper Congo basin. It extends into the Equatorial Forest in the north, but large forests give place to savannas farther south. The mean temperature decreases towards the south, and the European suffers more from cold than from heat in southern Katanga. A mountain chain, parts of it known under different native names, crosses the entire country from the headwaters of the Lualaba in the south to northern Tanganyika in the northeast.

The density of population bears a close relation to soil fertility. Population is dense in the north and along the Lualaba for a considerable distance to the south of Lake Kisale; but in the mining regions of the south and southeast, where the soil is poor, the villages are small. The natives belong chiefly to the Batetela tribes in the northwest, the Manuema in the northeast, the Marunga along the coast of Tanganyika south of the Lukuga River, and the Baluba in most of the remaining territory.

The Special Committee of Katanga, represented in Africa by Mr. Tonneau, was organized four years ago, and began its work in May, 1901. Since then it has established many stations, and secured safety of communication, and its authority is widely respected. Great importance is attached to the development of

better means of transportation, and to this end road-building has been pushed with much energy along the principal land routes, thus supplanting the tortuous native paths with good roads six feet in width. Such a road is now building between Pania Mutombo, the head of navigation on the Sankuru River, and Pweto, at the north end of Lake Moero. It is not continuous, for it is built to connect navigable stretches of water along the route. The construction of about 100 miles of road, including bridges, is completed, and several hundred miles of good wagon-roads have been built or are in progress in other parts of the country. It is expected in this way to replace freight carriage on the backs of men by traction.

At present, freight from Europe is brought by ocean steamer to Matadi on the Lower Congo, transshipped to the Congo railroad and carried to Stanley Pool, and then placed on a steamer which reaches Lusambo, at the northwest corner of Katanga, *via* the Congo, Kasai, and Sankuru Rivers; thence black porters, in the service of the Committee, take it east to Tshofa, on the Lomami River, whence it is distributed by bands of porters in all directions. Goods are delivered from Stanley Pool *via* Lusambo to Pweto, on Lake Moero, in 43 days, the distance in a straight line being over 1,000 miles, and much greater by the river and carrier routes.

Considering the length of rivers in Katanga, the navigable waterways are not extensive. They include, however, about 400 miles of navigation on the Lualaba, 30 on the Lufira, 86 on the Luvua. Studies are already beginning for the Katanga railroad, and it is expected before many years to bring mining machinery and other freight by steam from Europe to the southern frontier of Katanga.

The rubber harvest is not so large as was expected, because the plants were killed, to a great extent, by collectors before measures were taken to protect this Congo industry. Plantations for the cultivation of rubber are now opening. The quality of Katanga rubber is excellent, but the districts producing it will probably be confined to the Lomami and sections along the coast of Tanganyika and Moero.

Ivory is scarcely found in the country. The cultivation of European vegetables and other food plants at the stations is giving satisfactory results. Beef cattle, cows, sheep, and goats are kept at every station, excepting at certain points in the south, where the tsetse fly prevents the rearing of cattle. Abundance of fresh meat and milk are thus provided, and especial attention is given to

breaking oxen to the yoke, with a view to using them largely for road traction.

Katanga is especially rich in mineral resources. Mr. Tonneau's paper does not deal with the gratifying results of the search for metals, undertaken in the basin of the Upper Luapula by Director Williams in behalf of the Tanganyika Concessions; but Mr. M. H. Buttgenbach, who has reported on the mineral resources outside the regions to be exploited by the Tanganyika Concessions, estimates the copper-producing area as about 5,800 square miles, and says that the output of sixteen of these mines justifies the claim that the district Sud du Katanga will be one of the richest copper-producing districts in the world. The average richness of the ore is 14 per cent. copper, and Mr. Buttgenbach estimates that nine mines, which he names, will yield 1,200,000 tons of copper.

Gold exists in placers and in minerals of copper, but in the latter case the quantity is very small. The metal has also been discovered at Ruwe in a bed of auriferous quartz, bearing also platinum and silver.

Many deposits of tin have recently been discovered in the north of the mining region. Inexhaustible quantities of salt may be obtained from the noted salines of Mwashia, on the right bank of the Lufira, in 10° 41′ S. Lat., the deposits being the result of the evaporation of thermal waters issuing from numerous fissures.

The buildings occupied by the whites are usually built of brick, each white agent having a house to himself, with two well-aired rooms and a veranda. Every station has a garden, poultry, cattle, and potable water. The food is excellent, and there is scarcely any station, no matter how isolated, that lacks comfort. The Committee believes that it has completed the work of organizing the administrative machinery, and may now devote most of its time to the development of Katanga's resources.

SLEEPING SICKNESS IN KATANGA.—The *Bulletin* of the Société d'Études Coloniales (Aug.-Sept., 1904) says that sleeping sickness is afflicting the tribes of northern Katanga (the region of the Lomami), and small-pox is found to some extent in all parts of the country. In view of the fact that the physicians of Uganda have attributed sleeping sickness to a parasite introduced into the blood by a species of tsetse fly, it is very interesting to hear from Katanga that the physicians there report many cases of the disease in the Lomami region, and add that the tsetse does not exist in that part of the country. They mention, as additional proof that the fly does

not live there, that while its bite is fatal to cattle, these animals are thriving admirably at all the Lomami stations. On the other hand, southern Katanga is infested with tsetse fly; cattle cannot live there, but not a case of sleeping sickness has yet been reported.

THE INTERIOR OF ANGOLA.—Captain Boyd A. Cunningham describes in the *Geographical Journal* (August, 1894) a journey he has made into the far interior of Southern Angola, the Portuguese colony in West Africa. The region he describes is chiefly east of 15° E. Long., extending nearly to the frontier of the Congo State, and is the *hinterland* of the coastal region between Benguella and Mossamedes. Speaking of the rapid rise of the land from the coast to the interior plateau, he gives this table of altitudes along his route:

| DISTANCE INLAND FROM BENGUELLA. (MILES.) | ALTITUDE ABOVE THE SEA. (FEET.) |
|---|---|
| 57 | 1,350 |
| 117 | 2,500 |
| 120 | 3,000 |
| 160 | 4,800 |
| 180 | 5,400 |
| 200 | 5,900 |

The physical features of Angola may be said to consist of four distinctive belts, extending northeast and southwest: The *Coast Belt*, a sparsely-watered, sterile region extending inland from the coast 50 miles in the south and 150 miles in the north, its waters highly charged with sulphur and other minerals; climate hot and unhealthful, but might be ameliorated by sanitation; the *Mountain Belt*, extending 100 miles further inland, rugged and wild with luxurious vegetation, forests of tall hardwoods, fertile wooded valleys, and fairly abundant water; the *Highland Belt*, extending from the Congo to Humpata, 15° S. Lat., an undulating prairie plateau, 4,000 to 6,000 feet high, with wide, well-watered, treeless plains, a vast population of blacks, and the source of all the agricultural produce of the colony; and the *Inland Depression*, east of the Kwanza River, formed by the basins of the Kassai and Upper Zambezi. The expedition did not visit the last region.

The Boers who trekked into the country in 1880 and settled at Huilla and Humpata are now quite influential, and have in their hands practically the whole transportation of the land. The party visited the large and elevated Bihé district, which now, as ever, is the entrepôt of trade. In the days of the slave trade it was the col-

lecting region for the multitude of slaves that were shipped from Benguella. The sons of those undisciplined slave raiders have become carriers in the service of white traders. Most of the exports from Benguella are obtained by the natives of Bihé, who act as intermediaries between the natives of the rubber-producing districts of the Congo basin and the European trading-houses in southern Angola.

THE OVERFLOW OF THE NILE.—"The Annual Rise and Fall of the Nile" is the subject of a paper by Percival C. Waite in the *Scottish Geographical Magazine* for September. In this article a summary is given of the most important facts in relation to the floods of this most interesting river. The floods themselves will always be uncontrollable by human agency, but the surplus water, when the floods are subsiding, can be dealt with. The value of the Nile to Egypt, where practically no rain falls, has been recognized from the earliest times, and the Nile flood depends upon the fact that some of its headwaters come from a region of summer rainfall dependent upon the migration of the belt of equatorial rains north of the Equator. The Nile basin has, in reality, five great areas, viz.: 1. The Equatorial, with constant rainfall; 2. The Riverine, with heavy rain only in the summer; 3. The Abyssinian, with heavy rain only in the summer; 4. The Desert, without any rain; and 5. The Delta, with slight rain in the winter. The first area gives a constant flow of water, and the great lakes in it regulate the supply. The excess in the second and third areas gives the floods, mitigated, in the case of the White Nile, by temporary lakes caused by the overflowing of the low-lying country by the surplus water, and a large loss by evaporation. The Blue Nile and the Atbara are the principal cause of the annual inundation, and upon these depends the fertility of Egypt, for they bring down the rich sediment which forms the Delta and covers the land on each side of the river in Lower Egypt. Together with the Sobat, these rivers drain the greater part of the Abyssinian Mountains; they are torrential, and liable to rise suddenly. The White Nile has a more regular and steady supply of water, owing to the great lakes, which act as reservoirs, and this river prevents the lower part of the Nile from drying up altogether in summer. An early maximum on the Nile is derived principally from a "good" Blue Nile; while a late maximum is caused by a "good" White Nile. The Blue Nile is in flood from about June 5, and reaches its maximum about August 25, twenty-five days before the White Nile. The united maximum

occurs about September 5. The author of this paper finds a general agreement between the maximum rise of the Nile at Rhoda and sunspot periods. The years 1901 and 1902 were both years of low Nile, "but now we are approaching a sunspot maximum, and may look for better floods, on an average." R. DeC. W.

THE RUWENZORI REGION.—Dr. J. David, of Basel, was a member of a Belgian expedition that since the spring of 1903 has been making the preliminary studies for a railroad route through the great forest region between the Aruwimi River and Lake Albert Nyanza. The results of his observation of the pygmies on the Upper Ituri were published in *Globus* (Vol. 85, No. 8), and the same journal (Vol. 86, No. 4) tells of his killing an okapi and of his ascent to a high altitude of the Ruwenzori range. He is said to be the first European to secure a specimen of the okapi with his own gun, the skins and skeletons hitherto shown having been provided by the natives. Dr. David may be, therefore, in an excellent position to describe the physical character of the animal. This ruminant, he says, has not the bearing of an antelope, as many imagine, but much more nearly resembles a tapir. Its stripes are more beautiful than those of the zebra, and are usually double, white within black. The back is reddish; particularly in the males; the ears are very large and adorned with tufts of hair, and the mane is erect. Some of them of both sexes have horns, while others have none, whence Dr. David infers that there are at least two species. The height of the okapi at the withers is 3.9 to 5 feet.

Another interesting zoological find was an armadillo slightly over four feet in length, living on mice and worms, and closely resembling its congener of the pampas. It usually sits erect, partly supported by its tail, and embraces the tree trunks between its powerful fore claws.

Dr. David is an experienced mountaineer, and this contributed to his success in climbing the western slope of the Ruwenzori range.* Dr. David estimates the height he reached at 16,700 feet, which, if correct, is the highest yet made in this region. He says that the range is composed of a series of granite, diorite, and diabase ridges; he saw no porphyry or basalt. The snow-line is at an elevation of about 14,500 feet; but the glaciers go lower, to about

* According to the Rev. A. B. Fisher (*Geog. Jour.*, Sept., 1904) the few persons who tried to climb the range attacked it from the east side, and he believes they might have succeeded better on the west side. But, in fact, Stairs, Elliott and Stuhlmann climbed from the west.

13,000. Near the two glacier tongues which he visited were two small moraine lakes, and a little below them was a third lake of milky-green colour, surrounded by thick vegetation; while a fourth, which was fed by glacier streams, was clear, though of a greenish-brown colour, perhaps derived from the neighbouring moorland.

On the west side of the range seven zones of vegetation are distinctly defined—the humid forests spreading over the swamp, grass and sedge lands of the Semliki River; the region of ferns and orchids, with tobacco culture between 5,200 and 7,200 feet; the bamboo zone, with the highest permanent settlements of the natives between 7,200 and 7,900; the high moor, with thick mosses saturated with water, lying between 8,000 and 11,800 feet; the fifth, sixth, and seventh zones are all moorland of one sort or another. The *Senecio Johnstoni* was found up to 12,800 feet. There was a striking absence of flowers and of the lush dwarf vegetation characteristic of the Alps. Dr. David collected on Ruwenzori over 100 species of plants.

## ASIA.

THE RAILROAD AROUND LAKE BAIKAL.—The Russians have practically completed the link in the Siberian Railroad around the south end of Lake Baikal. It follows the shore-line between the completed portions of the railroad from Baikal station, at the mouth of the Angara River on the west coast, to Myssowek on the east coast. The road is only about 160 miles in length, but it has presented the most serious engineering difficulties. The calculated expenditure was $26,261,840, making it the most expensive bit of railroad ever built in the Russian Empire. It will obviate the ferriage of trains across the lake, which is very troublesome in winter. Ice-breakers have been used, or freight has been hauled on sledges; and on the outbreak of hostilities a track was laid across the ice.

The greatest difficulties in building were met between Baikal station and Kultuk, at the southwest corner of the lake. The distance is only 52 miles, but the coast is very mountainous, and with only a narrow foreshore, while in many places the mountains descend sheer to the lake. The line winds along the side of or makes its way through the mountains. In this short section there are 32 tunnels, besides 210 bridges, viaducts, and special supports. The looseness of the rock necessitated the bricking up of the tunnels to a far greater extent than had been expected.

Along the other section, from Kultuk to Myssowek, the mountains recede further from the shore, leaving flat land for the railroad,

which passes through only one tunnel; but several large streams must be crossed, so that a number of bridges up to 500 feet in length were required. The road has only one line of rails, but tunnels have been built to accommodate two lines. It is calculated that at present seven trains will be able to pass daily in each direction.

## AUSTRALASIA.

A Bathymetrical Survey of the Lakes of New Zealand.—The *Geographical Journal* describes (May, June, 1904) the survey that was made in 1902 of the principal lakes of New Zealand, the primary purpose being to obtain some knowledge of the forms of the lake basins, upon which to base a biological study of the lakes. Compared with the detailed work done in the lakes of Europe the surveys were not minute, but they were sufficient for the drawing of rough contour lines in all parts of the lakes. Two of these lakes are among the deepest in the world. They are Wakatipu and Manapouri, among the New Zealand Alps, in the southern part of the South Island; all the other lakes surveyed being in the North Island.

Lake Wakatipu is 49 miles long, and the water surface has an area of 112.3 square miles, and is 1,016 feet above sea-level. The maximum depth is 1,242 feet, and the mean depth 707 feet. Few lakes reach so great a mean depth. Lake Manapouri, whose outline is very complicated, has an area of 56 square miles, inclusive of a number of small islands, its surface lying approximately 597 feet above sea-level. The greatest depth found was 1,458 feet, which occurs in a large depression, 2.7 square miles in area, all of which exceeds 1,400 feet in depth. This deepest depression is surrounded by the highest and steepest slopes that the shores afford. In contrast with these maximum depths of 1,242 and 1,458 feet in comparatively small lakes it may be mentioned that the maximum depths of our great lakes are: Superior, 1,008 feet; Michigan, 870; Ontario, 738; Huron, 730; and Erie, 210. These two lake basins in New Zealand seem to be an integral part of the surrounding country, their slopes continuing the slopes of the mountain sides. They are mountain valleys filled with water, and if drained dry would not appear in any way remarkable.

Taupo and Rotoiti appear to the historian of the survey, Mr. K. Lucas, to be of tectonic origin, the basin of Taupo, for example, being a trough abruptly sunk in the surface, the perpendicular cliffs of the west shore dropping suddenly down from among hills

of comparatively gentle slope. Waikare Moana is a valley lake, and Waikare and Whangape are so shallow as to rank rather with swamps than with lakes. The following table condenses the more important facts to be found in the report on the survey:

| | AREA. SQ. MILES. | HEIGHT ABOVE THE SEA. FEET. | GREATEST DEPTH. FEET. | MEAN DEPTH. FEET. | NUMBER OF SOUNDINGS PER SQ. MILE. |
|---|---|---|---|---|---|
| Taupo | 238 | 1,211 | 534 | 367 | 2.6 |
| Wakatipu | 112.3 | 1,016 | 1,242 | 707 | 1.7 |
| Manapouri | 56.0 | 597 | 1,458 | 328 | 3.6 |
| Rotorua | 31.6 | 915 | 84 | 39 | 5.6 |
| Waikare Moana | 20.8 | 2,015 | 848 | 200 | 12.9 |
| Rotoiti | 14.2 | 910 | 230 | 69 | 12.6 |
| Waikare | 10.7 | ? | 9 | 4.6 | 19.8 |
| Whangape | 4.0 | ? | 9 | 4.5 | 95.0 |

THE NEW ZEALAND YEAR BOOK FOR 1903.—The twelfth issue of the *Year Book* has an article on the social organization and life of the Maori people prior to the advent of the Europeans. They still maintain the old practices, in some respects. Marriages are still often arranged by the uncles and aunts of a girl, the parents taking little or no part in the matter. The marriage of near relatives, such as first cousins, was and is abhorred, for cousins are termed brothers and sisters in accordance with the native conception of the social unit. The census of the Maori population, taken in 1901, showed 43,143 persons—a decrease of 2,327 since the first census in 1874. The Europeans are eighteen times as numerous. Among other articles of geographical interest is a description of the district of Rotorua, with its great variety of hot mineral springs and lakes, remarkably coloured by mineral matter in solution. The hot swimming baths, maintained both for those who come "for the cure" and for tourists, are among the finest in the world. The tourist and health resorts supported by the Government at Hanmer Hot Springs, Mount Cook, and the southern lakes are also described. New Zealand is exceptional in having a Government Tourist Department, and under its control is the hotel near the base of Mt. Cook (12,348 feet), in the heart of the Southern Alps. A journey of 96 miles by coach, from Fairlie on the railroad, lands the tourist at the hotel. Here guides and horses are obtained for visits to the glaciers, including the great Tasman Glacier. Many Alpine excursions are made from two huts erected at higher elevations among the mountains.

## POLAR.

Failure to Reach Franz Josef Land this Season.—The failure of Mr. W. S. Champ's first attempt this year to find a way through the ice of Barents Sea on the steamer *Frithjof* and carry supplies to the Ziegler-Fiala Arctic Expedition, which is supposed to be in Franz Josef Land, was recorded in the August Bulletin (p. 488). His party sailed again from Vardö, but his second attempt was equally unsuccessful. Mr. Champ, who has returned home, says the *Frithjof* will make another attempt to reach Franz Josef Land in June next year.

## FORESTS AND CLIMATE.

The relation of forests to rainfall, evaporation, transportation and run-off is discussed by James W. Toumey in the Year-book of the Department of Agriculture for 1903 ("The Relation of Forests to Stream Flow"), special reference being made to a series of observations which have been going on for several years in the San Bernardino Mountains, in southern California. So close is the relation between precipitation and forest cover in that region that "it is possible to judge the mean annual precipitation with a fair degree of accuracy from the appearance of the forest alone." The writer, however, points out that the differences in rainfall are the cause rather than the effect, and that while it is reasonable to infer that forests may have some influence in increasing precipitation, because of their known effect on temperature and on relative humidity, no definite answer to this question can yet be given. That evaporation from water or other wet surfaces on the floor of forests is one-third or one-fourth of that from similar surfaces in the open has been shown both by European observations and by those in the San Bernardino Mountains. In the latter case the first foot of depth in the mineral soil in the forest may contain two or three times as much moisture as soil of the same general character from similar situations in the open. The evaporation of snow in our western mountains is due largely to dry winds, and in the San Bernardino Mountains a foot of snow is sometimes evaporated in two or three days without moistening the soil. As forests check wind movement and provide shade, they must lessen evaporation. The importance of forests in sustaining the flow of mountain streams and in regulating the run-off is emphasized.

R. DeC. W.

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Goodrich, S. G.—Pictorial Geography of the World. (10th edition.) Boston, C. D. Strong, 1841. 2 vols. 8vo. [*Gift, from Nathan Appleton, New York.*]

Wagner, H. [*Editor*].—Geographisches Jahrbuch. Band XXVI, 1903. 1e u. 2e Hälfte. Gotha, Justus Perthes, 1903–04. 8vo.

## MAPS.

AFRICA. EGYPTIAN SUDAN. Sheets Nos. 55–B, Khartoum; and 55–F, Ma'atuk [of a large-scale map of Africa], compiled in the Intelligence Division, War Office. London, 1902. *Scale:* 4 miles = 1 inch. *Size:* [of each sheet] 25⅝ x 17⅝ inches. Lithographed. [*Gift, from the War Office, London.*]

[AFRICA] MAROC, Carte du.—Dressée et dessinée par R. de Flotte de Roquevaire. Paris, H. Barrère, 1904. *Scale:* 16 miles = 1 inch. *Size:* 49½ x 36 inches. Engraved and lithographed in colours. Muslin, dissected, folded in case. [Accompanied by Notice et Index Bibliographique.] [*Gift, from the Authors, through M. G. Grandidier.*]

[AFRICA.] MISSIONSKARTE VON AFRIKA. Bearbeitet nach der neuesten Ausgabe der "Missiones Catholicae" und anderen authentischen Quellen von P. H. Hansen, S.V.D. Glogau, Carl Flemming, 1903. *Scale:* 1 : 14,500,000 = 232 miles = 1 inch. *Size:* 29¼ x 23½ inches. Lithographed in colours.

AFRICA. NIGERIA, CENTRAL.—Sheet 62 [of a large-scale map of Africa], compiled in the Intelligence Division, War Office, London, 1902. *Scale:* 16 miles = 1 inch. *Size:* 26 x 17⅜ inches. Engraved and lithographed in colours. [*Gift, from the War Office, London.*]

AFRICA, NIKKI.—Sheet 61 [of a large-scale map of Africa] compiled in the Intelligence Division, War Office, London, 1902. *Scale:* 16 miles = 1 inch. *Size:* 26 x 17½ inches. Engraved and lithographed in colours. [*Gift, from the War Office, London.*]

ANDAMAN ISLANDS. [With 2 Insets: Barren Island Anchorage; Table Island and Marshall Channel. View of Table Island Lighthouse.] London, Admiralty Chart No. 825. Revised to 1902. *Scale:* 7½ nautical miles = 1 inch. *Size:* 24½ x 37¾. Engraved on copper.

[ASIA.] PHYSIKALISCHE KARTE VON ASIEN, entworfen, gezeichnet und herausgegeben von Gustav Richter, Görlitz. Essen, G. D. Bädeker. [1904.] *Scale:* 112 miles = 1 inch. *Size:* [6 sheets joined] 76 x 59 inches. Lithographed in colours.

BOLIVIA, MAPA DE LA REPÚBLICA DE. Levantado y construido......por el Inj. Franz Germann. Hamburgo, L. Friederichsen & Co., 1904. *Scale:* 31 miles = 1 inch. *Size:* [4 sheets joined] 36 x 43¾ inches. Engraved and lithographed in colours.

CANADA, NORTH-WESTERN.—Map showing Mounted Police Stations. 1904. Ottawa, Privy Council. *Scale:* 35 miles = 1 inch. *Size:* [2 sheets joined] 48½ x 36¾ inches. Photolithographed in colours. [*Gift, from James White, Geographer, Ottawa.*]

CANADA. NORTH-WEST TERRITORIES. Map showing the Mounted Police Stations. 1904. Ottawa, Privy Council. *Scale:* 12½ miles = 1 inch. *Size:* [2 sheets joined] 51¼ x 33½ inches. Photolithographed in colours. [*Gift, from James White, Geographer, Ottawa.*]

CANADA. ONTARIO, Windsor Sheet. [Being Sheet 1. S. W. of the Standard Topographical Map.] [Ottawa] Dept. of the Interior, 1904. *Scale:* 3.95 miles to 1 inch. *Size:* 26½ x 35½ inches. Engraved and lithographed in colour. [*Gift, from James White, Geographer, Ottawa.*]

CANADA. RAILWAYS IN MANITOBA, ASSINIBOIA, ALBERTA AND SASKATCHEWAN. [Ottawa] Dept. of the Interior, 1904. *Scale:* 35 miles = 1 inch. *Size:* 31½ x 15¼ inches. Engraved and lithographed in colours. [*Gift, from James White, Geographer, Ottawa.*]

[CHINA, KOREA, JAPAN.] CARTA DELLA CINA ORIENTALE, COREA, GIAPPONE ED ESTREMO ORIENTE RUSSO; pubblicata dall' Istituto Cartografico Italiano di E. Calzone, Roma. [1904.] *Scale:* 45 miles = 1 inch. *Size:* 35⅜ x 26¼ inches. Lithographed in colours. [*Gift, from E. Calzone, Rome.*]

[HAYTI.] ST. DOMINGO, PLANS OF PORTS.—Monte Christi and Manzanillo Bays; Tiburon Bay; Anchorage of Juan Rabel; Cabarete Anchorage; Approach to Sanchez; Chouchou and Salt River Bays; Moustique Bay; Port A l'Ecu; Caldera Bay; Tierra-Baja Road; Fond La Grange; Port Paix. London, Admiralty Chart No. 2406. Revised to 1892. *Various scales. Size:* 18¾ x 24¼ inches. Engraved on copper.

ITALY. STRADE FERRATE ITALIANE, Carta delle. Al 1º Luglio, 1904. [With 15 inset City plans.] Roma, E. Calzone. *Scale:* 23⅓ miles = 1 inch. *Size:* 24¼ x 33 inches. Lithographed in colour. [*Gift, from the Istituto Cartografico Italiano di E. Calzone, Rome.*]

JAPAN.—Geological Map of the Japanese Empire on the scale of 1 : 1,000,000, compiled by the Imperial Geological Survey of Japan, 1902 [15 sheets]; Outlines of the Geology of Japan: Descriptive Text to accompany the Geological Map, Tokyo, Geol. Survey, 1902, 8vo. [*Gift, from Dr. phil. T. Nasa, of Tokyo.*]

JAPAN.—YEZO ISLAND, with the adjacent Straits of Tsugaru, La Perouse, and Yezo. London, Admiralty Chart No. 452. Revised to 1904. *Scale:* 12 nautical miles = 1 inch. *Size:* 37¾ x 24½ inches. Engraved on copper by Edward Weller.

LOUISIANA AND NEW ORLEANS, Charts and Plans Illustrating, etc. Joseph Jones, Collector and Classifier. New Orleans, 1882. *Sheet.* [*Gift, from W. Beer, Howard Memorial Library, New Orleans.*]

NICARAGUA, From Official and other Sources. Prepared in the International Bureau of the American Republics. W. W. Rockhill, Director. Washington, 1903. *Scale:* 12½ miles = 1 inch. *Size:* 27 x 27½ inches. Photo-Lithographed. [*Gift, from the International Bureau of American Republics.*]

NICARAGUA.—Same as the above, with Agricultural Features.

NORTH SEA.—SCHEVENINGEN TO AMELAND, INCLUDING THE ZUIDER ZEE. London, Admiralty Chart No. 2322. Revised to 1902. *Scale:* 3 nautical miles = 1 inch. *Size:* 24⅝ x 37⅝. Engraved and lithographed.

PANAMA, ISTHMUS OF.—Map . . . representing the line of the Panama Railroad as constructed under the direction of George M. Totten. Jamaica, 1857. *Scale:* 1 mile = ¾ of an inch. *Size:* 27¾ x 36 inches. Lithographed. [*Gift, from Nathan Appleton, New York.*]

[PHILIPPINE ISLANDS.] ISLAS FILIPINAS.—Francisco Coello. [*3 sheets from the Atlas de España y sus Posesiones de Ultramar, published separately and folded in covers.*] Madrid, 1852. *Scale:* 16 miles = 1 inch. [With 23 inset maps, various scales.] *Size:* 3 sheets joined, 39¼ x 82 inches. Engraved on copper, coloured by hand.

ROMA, SUBURBIO E DINTORNI. Pianta Topografica pubblicata dall' Istituto Cartografico Italiano di E. Calzone. Roma, 1904. *Scale:* about 3 inches = 1 mile. *Size:* 23¼ x 30 inches. Engraved and lithographed in colours. [*Gift, from E. Calzone, Rome.*]

SEYCHELLES GROUP, with the Amirante and other outlying Islands. London, Admiralty Chart No. 721, revised to 1898. *Scale:* about 9 nautical miles = 1 inch. *Size:* 37⅞ x 24¾ inches. Engraved on copper.

## NEW ZEALAND.

Courte, Comte de.—La Nouvelle Zélande. 88 gravures. Paris, Hachette et Cie, 1904. 8vo.

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## VARIOUS.

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[Lake Balaton.]—A Balaton Tudományos, etc. Budapest, 1897–1903. [13 Parts in case. With maps.]

[Lake Balaton.]—Die Bisher Erschienenen Theile des Werkes. Resultate der Wissenschaftlichen Erforschung des Balatonsees. Wien, 1897–1903. [9 Parts in case. With maps.]

Varga Otto.—Közepiskolai Földrajz I & II, Budapest, 1900, 8vo; Politikai Földrajz, Budapest, 1903, 8vo.

Kirchner Béla és Pataki Simon.—Földrajz. 1 Resz. Budapest, 1904. 8vo.

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Sziklay János és Borovszky Samu.—Magyarország Varmegyéi és Városai. [With Plates.] Budapest, "Apollo," s. a. 4to.

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Körösy, Josef.—Monatshefte des Budapest. Communal-Statistischen Bureaus. 31. Jahrgang, 1903. Nr. 357–358. Budapest, Grill-Károly, 1903. 8vo.

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KÖRÖSY, JOSEF, UND THIRRING GUSTAV.—Die Hauptstadt Budapest im Jahre 1891, Band I, II, III, Berlin, Puttkammer & Mühlbrecht, 1894–1898, 8vo; Die Hauptstadt Budapest im Jahre 1901, Band I, 1te u. 2te Hälfte, Berlin, . . . 1903–1904, 8°.

KÖRÖSY, JOSEF.—Die Sterblichkeit der Haupt- und Residenzstadt Budapest, 1901–1905. IIter Theil, 2tes Heft, 1902. Berlin, Puttkammer u. Mühlbrecht, 1904. 8vo.

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KOGUTOWICZ MANO.—Földrajzi Atlasz. Budapest, Földrajzi Intézet, 1903. 4to.

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BULLETIN HYDROMÉTRIQUE des principales Rivières de la Hongrie. [14 sheets.]

CARTE POSTALE ET TÉLÉGRAPHIQUE des Pays de la Couronne de Hongrie. 8 feuilles, 1:400,000. Budapest, Direction Générale...des Postes, 1902.

BÉLA VALYI.—Carte synoptique de la Vallée du Danube. 1:400,000. [2 sheets and Key.]

BÉLA VALYI.—Carte synoptique de la Vallée de la Tisza. 1:400,000. [2 sheets, and Key.]

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ENCYCLOPÆDIA, JEWISH.—Vol. VII. Italy-Leon. *Illustrated.* New York and London, Funk & Wagnalls Co., 1904. 8°.

[ENCYCLOPÆDIA.] MEYERS Grosses Konversations-Lexikon (6te. Auflage). Band VII. Leipzig u. Wien, Bibliographisches Institut, 1904. 8°.

HESS, HANS.—Die Gletscher. [Illustrations and maps.] Braunschweig, Fr. Vieweg u. Sohn, 1904. 8vo.

LEYPOLDT, A. H., *Editor.*—Publishers' Trade List Annual, 1904. Supplementary Index. New York, Office of the Publishers' Weekly, 1904. 8vo.

MICHAELIS, H.—New Dictionary of the Portuguese and English Languages . . . Based on a MS. of Julius Cornet. Leipzig, F. A. Brockhaus, 1893. 2 vols., 8vo.

WERTHER, C. WALDEMAR.—Östliche Streiflichter. Kritische Beobachtungen und Reiseskizzen. [Illustrated.] Berlin, Hermann Paetel, 1903. 8vo.

# NEW MAPS.

## AMERICA.

UNITED STATES.—(a) Map showing the Distribution of the Principal Clay-Bearing Formations of New Jersey. Scale, 1:316,800, or five statute miles to an inch.

(b) Map showing the Distribution of Clay Pits and Clay Manufactures in New Jersey in 1903. Scale, 1:316,800, or five statute miles to an inch.

(c) A Map of the Clay Formations in Northeastern Middlesex County, N. J. Scale, 2,000 feet to an inch.

(d) Map showing the Clay Formations near Keyport and Mattawan, N. J. Scale, 2,000 feet to an inch.

These four maps accompany Vol. VI of the *Final Report* of the State Geologist of New Jersey, published at Trenton in 1904. The volume, "Clay Industry," is devoted to the stratigraphy and economic geology of the New Jersey clays, the properties of clays, and their manufacture and economic applications.

MAGELLAN STRAIT.—Estrecho de Magallanes (Sheets, Canal i Puerto Condor i Lago de la Botella and Puerto Zenteno, Canal Tortuoso i Laguna Baja). Scale, 1:20,000, or 0.3 statute mile to an inch. Hydrographic Office, Valparaiso, Chile, 1903.

Two sheets of the chart of Magellan Strait, with numerous soundings taken from the British charts, soundings and altitudes in metres, and land-forms shown with the effect of relief. No lines of latitude or longitude, but the position of one point on each chart approximately indicated.

## EUROPE.

GERMANY.—Die Schiffsunfälle an der Deutschen Küste. Scale, 1:250,000, or 19.7 statute miles to an inch. Vierteljahrshefte zur Statistik des Deutschen Reichs, Vol. 13, No. 3. Imperial Statistical Office, Berlin, 1904.

This is a model for maps of the kind. The disasters to shipping on the navigable inland waters and on the sea within 20 nautical miles of the coasts are shown for the five years 1898–1902. Forty-four different symbols are used to show different kinds of accidents and their results. One symbol, for example, shows that a sailing vessel was stranded and lost; another that it was stranded and got off again. Two other symbols give the same information concerning a steamship. Thus a condensed history of five years of marine accidents is given. An inset on the larger scale of 1:600,000, or 9.4 statute miles to an inch, gives this information in greater detail for the North Sea Coast.

## ASIA.

JAPAN.—Geological Map of the Japanese Empire. Scale, 1:1,000,000, or 15.7 statute miles to an inch. Compiled by the Imperial Geological Survey of Japan. Tokio, 1904.

This fifteen-sheet map shows that the Japanese are not behind other nations in the fine art of map-making. Their cartographers studied the art in its modern development in Europe, and they are excelling in their application of what they have learned. Fourteen tints are used to show geological formations, and ten shades of blue denote the contours of the neighbouring sea-floor as far as it has been surveyed.

With all this great variety of tints on a small-scale map the colours are as sharply registered as on any map. The Japanese have evidently mastered the art of colour-printing. The work can, however, be regarded only as preliminary to a complete map, inasmuch as the detailed topographical survey has not yet been finished, and it is, therefore, impossible to assign exactly correct positions to all the formations outlined; but the map is noteworthy as the first fairly exact geological map of Japan. No contours are shown for the land surface, but there is a table of the names and elevations of 165 volcanoes, of which 59 are marked as active. An inset shows the distribution of the volcanoes and the extent and position of the volcanic zones both on land and sea.

The authors of the descriptive text *Outlines of the Geology of Japan*, prepared to accompany this map, have interpreted their duty so literally that the first half of the book (about 100 pages) is little more than a catalogue of the rock exposures throughout the empire. A connected and interesting history of the geology of Japan, in the light of the present knowledge of it, is yet to be written. One fact adduced is that, although the empire has 165 volcanoes, only 19.16 per cent. of the total area of Japan is occupied by volcanic rocks.

## AFRICA.

Togo.—Karte der deutsch-englischen Grenze in Tschokossi-Mamprussi-Gebiet. After the surveys of Graf Zech and Frhr. v. Seefried, of the German Boundary Commission, 1902. Prepared by P. Sprigade: 1:100,000. *Mitt. aus den deutsch. Schützgeb.*, Vol. XVII, No. 3, Berlin, 1904.

Shows boundary posts, triangulation points, chief towns, and roads.

Togo.—Die neue Westgrenze von Togo. Scale, 1:2,000,000, or 31.3 statute miles to an inch. *Deutsche Kolonialzeitung*, No. 41, 1904, Berlin.

The treaty between Germany and Great Britain, signed June 25, defines the boundary from 9° N. Lat. northward to the French Sudan between the northwestern part of Togo and the northern Territory of the British Gold Coast Colony. The entire boundary of Togo is now established, which cannot be said of any other of the German protectorates in Africa.

Rhodesia.—Railroad Distances in Rhodesia. Scale, 110 statute miles to an inch. *Report* of the British South Africa Company for the Year ending March 30, 1903. London, 1904.

The latest map of railroad progress and projects in this part of Africa from the Orange River and Kimberley in the south to Lake Tanganyika in the north. All the railroads in operation, building, or projected, with all the stations, coal and other mining fields, are shown. The Rhodesian system of railroads begins at Vryburg in the south, and the rails now extend to Victoria Falls on the Zambezi in the north. The gauge is 3 feet 6 inches, which is standard in South Africa. The road from Salisbury to Ayrshire, 83 miles, however, is only of two-feet gauge.

## THE WORLD.

World.—Coaling Stations of Great Britain and the United States. Mercator Projection. *Proceedings* of the United States Naval Institute, Sept., 1904. Annapolis, Md.

A black-and-white map showing the distribution of the coaling stations of these nations (away from home). Ships may take coal at 98 places in the United States and at 88 places in the United Kingdom.

World.—Übersichts-Karte der seebebenartigen Erscheinungen. Scale at the

Equator, 1:80,000,000, or 1,262 statute miles to an inch. By Wilhelm Krebs. *Globus*, No. 11, Braunschweig, September, 1904.

The map indicates the position at sea from which seaquakes have been reported, the locations of submarine eruptions, and the places along coasts where earthquake and eruption waves have made themselves felt.

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## BOOK NOTICES.

*Earthquakes in the Light of the New Seismology. By Clarence Edward Dutton, Major U.S.A. 314 pp. G. P. Putnam's Sons.*

This volume is a reminder, hardly needed by the geologist, that Major Dutton was for many years a member of the U. S. Geological Survey, and is the author of the *Tertiary History of the Grand Canyon District*, *The High Plateaus of Utah*, *Hawaiian Volcanoes*, and *The Charleston Earthquake.* The present theme is too technical to allow much liberty of style, but one who has read the author's reports is not surprised to find a dash of eloquence on an early page in the general description of an earthquake.

The new seismology requires us to think of the earthquake, not as a cause, but rather as an effect, or incident of geological changes. We must also discard the notion of "earthquake weather," or other trustworthy signs of the coming of such disturbances. The cause of earthquakes is taken up early, and this discussion is followed by chapters on quakes of volcanic origin, and dislocation, or tectonic, quakes. The term "quake" is used throughout for the longer and more familiar word. Earthquakes by downthrow of parts of the earth's crust seem well verified; but the theory must not be carried too far, and does not, in the light of modern knowledge, require the existence of great subterranean cavities.

The association of quakes with volcanoes, in a casual way, is said to be as old as Aristotle. This is a valid principle, first really developed by Von Buch and Humboldt. The careful study of large numbers of modern quakes, however, shows that volcanic connections are absent in the greater number of cases, though a recognized cause in some. Volcanic quakes are not often felt at long distances from their point of origin, although they may be extremely violent about their epicentres. Thus in the earthquake of Casamicciola, on the island of Ischia, in 1883, 1,900 people were killed; while only a faint tremour was felt at Naples, but twenty-two miles away. The destructive shock connected with an eruption of Mount Ararat, in

1840, had a similar local character. Even Krakatoa, in one of the most violent eruptions on record, produced small vibrations at Batavia, only ninety miles distant, although it is well known that atmospheric and water waves were capable of detection in remote parts of the world. There is also, without doubt, much subterranean vulcanism, as in the intrusion of sheets and dikes, which is capable of producing seismic disturbances.

Tectonic quakes are due to dislocations of strata in great movements of the earth's crust. The well-known shocks in Chile, in 1822 and 1835, are cited as examples; also the New Zealand quake of 1855, as described by Lyell in the *Principles of Geology.* A more recent example occurred in Japan in October, 1891, where faulting was observed for a distance of seventy miles. Tectonic quakes, in distinction from volcanic, are followed by after-shocks of diminishing severity. The most "powerful and widespread" quake recorded in history took place in northeastern Bengal and Assam in 1897. The epicentral area was six thousand square miles in extent, and two hundred miles long, illustrating the further principle that in tectonic shocks the centre of disturbance is not well defined. In re-surveying, relative changes as great as twenty-five feet were found in the height of hills, and changes of twelve feet in horizontal distances.

The retreat of water, often occurring on sea borders, is freely attributed to sudden sinking of an area of sea-bottoms off shore, and an uprising is assumed in the rarer case in which the incoming wave first appears. Fresh evidence is cited regarding the Lisbon earthquake. It is from an eyewitness, in a pamphlet written soon after the event, and is noteworthy as making no reference to the widely-reported sinking of a quay, with the engulfing of a large number of people. The greatest amplitudes of earthquake waves are never recorded, since they are sufficient to wreck or overthrow the instruments, but they are known to reach at least a foot. This amplitude is attained only in soft ground, near the epicentre of a very violent movement. The amplitude in firm rock is probably never above two inches. The vertical amplitude is always less than the horizontal. It will not be without interest at the present time to note the large number of refined studies which our author cites as having been made by Japanese scholars.

The foci of volcanic quakes are especially shallow, but all quakes are characterized as "skin-deep." It is practically certain that no foci are so deep as thirty miles, and they are all probably within twenty miles of the surface.

The closing chapters of the book are mainly devoted to the more geographic aspects, of distribution and charting of the various regions of "seismicity." In determining the seismicity of a region both the frequency and the intensity are taken into account. Here the difficulty is in the fragmentary nature of the records in most parts of the world. M. De Montessus de Ballore is given credit for more extensive research in this field than all other seismologists combined, and his tables of distribution are republished as an appendix to this volume. The sources of knowledge are: historic narratives, not of scientific purpose, observations of sensible quakes without instruments, and seismographic observations, made with recording instruments. In a note on page 245 the author refers to the sensitiveness of the region about New Madrid, Mo., centre of the great shocks of 1811–12, and tells us it is doubtful whether the after-shocks have ceased even yet. This is, of course, a quake of the tectonic order, in which slips, with minor reliefs of strain, might continue for a long time.

It will surprise many readers to learn that Japan earthquakes do not tend to associate themselves with volcanoes. Most are tectonic and originate at sea, on the slope of sea-bottom that leads down to the Tuscarora Deep. Perhaps three per cent. of Japanese earthquakes are volcanic. The same is true of most Philippine disturbances. Japan and the Philippines are not, however, parts of a "fiery great circle," for there is no proof of exceptional seismicity between these two fields. Tectonic shakings originate in connection with the deeps near the Aleutian chain, and the California quakes suggest a tectonic origin. On the other hand, the Central American and South Mexican disturbances indicate volcanic origin, the interdependence of the two classes of phenomena being close and obvious. Both sorts of quakes are probably common, and intermingled along the Andes.

De Montessus de Ballore's deduction from distributions is that earthquakes occur where the variations of topographic relief are greatest—that is, along the great lines of corrugation of the earth's crust, either as they follow the lands, or sea-bottoms. Earthquakes are especially common in mountain regions and along the steepest flanks of mountains and on rapidly-deepening sea-bottoms. The quakes of Cuba and of neighbouring islands thus fall into relation with diversified and profoundly-submerged surfaces of that region.

A. P. B.

## NOTES AND NEWS.

THE NEXT MEETING OF THE SOCIETY will be held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, November 22, 1904, at 8.30 o'clock P.M.

Mr. Oscar T. Crosby will address the Society on his travels in Central Asia.

MR. F. H. NICHOLS IN TIBET.—In a letter written from Mandalay, Burma, on the 20th of September, Mr. Nichols tells of his experiences in eastern Tibet. News of the British advance to Lhasa had reached him in Yunnan, and he was prepared to meet with obstacles in attempting to approach that city from the east; but there was no sign of trouble till the end of the sixth day's march, when his men refused to go any farther, declaring that they would all be killed. After some days spent in fruitless discussion, Mr. Nichols was compelled to retrace his steps and dismiss his men. He then made his way to Burma, where he will remain until he decides upon his future movements.

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U. S. BOARD ON GEOGRAPHIC NAMES. DECISIONS, OCTOBER 5, 1904.—

AMERICAN; stream, tributary to Bumping River, Yakima County, Wash. (Not American River, Miners Creek, Miner, nor Miners.)

BEER; kill, town of Wawarsing, Ulster County, N. Y. (Not Good Beer nor Beer Kill.)

CARMANS; river and creek, in the town of Brookhaven, Suffolk County, N. Y. (Not Connecticut, Carman's, nor Connectiquot River.)

COECLES; arm of Gardiner's Bay, Shelter Island, Suffolk County, N. Y. (Not Coecle Harbor Inlet, Coecle's Harbor Inlet, Coeclis Inlet, nor Cockles Harbor.)

GABILAN; mountain range and peak between Monterey and San Benito Counties and creek in Monterey County, Calif. (Not Gavilan nor Fremont.)

HEADY; creek, forming boundary between Southampton Village and the Shinnecock Indian Reservation, Suffolk County, N. Y. (Not Header.)

JENNINGS; the northwest point of Shelter Island, Suffolk County, N. Y. (Not Rocky nor Stearns.)

KETCH; brook, tributary to Scantic River, Hartford and Tolland Counties, Conn. (Not catch.)

LEELANAU; county in Mich. (Not Leelanaw).

NORTHWEST; harbor, town of Easthampton, Suffolk County, N. Y. (Not West, Northwest Harbor, nor Northwest Bend.)

PEEKAMOOSE; mountain in the town of Denning, Ulster County, N. Y. (Not Peak o' Moose, Peakamoose, nor Peek O'Moose.)

PICACHO; peak, San Diego County, Calif. (Not Chimney.)

ROBINS; island in Suffolk County, N. Y. (Not Robin's nor Robbins.)

SEBONAC; neck in town of Southampton, Suffolk County, N. Y. (Not Sebonack nor Seponack.)

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We regret to record the death at Cherbourg, on the 20th of August, in his 81st year, of M. AUGUSTE-FRANÇOIS LE JOLIS, founder and director of the Société Nationale des Sciences Naturelles et Mathématiques de Cherbourg.

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## THE EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.

### SEPTEMBER 8–22, 1904.

The meeting of the Congress in the United States extended over a period of sixteen days. This prolongation of the time was more apparent than real, for several days were given to excursions, sight-seeing and travel—pleasurable features that usually precede or follow the business and scientific sessions. The American hosts and their guests were favoured, on the whole, with fine weather. The hot spell, common in September, did not appear, and it was so cool on the evening of the reception to President Peary in St. Louis that many wore overcoats.

The delegates and members numbered about 750, including 75 ladies, who were classed as Associate Members. The list was therefore not quite half so long as that of the Berlin Congress, where 1,600 names were enrolled; and the London Congress nearly equalled Berlin. About four-sevenths of the persons enrolled were in attendance, though many of the Americans were present in only one or two of the cities in which the Congress convened.

Nearly all the foreign guests went the complete round from Washington to St. Louis. They numbered about seventy-five, most of them from Great Britain, France, Germany, and Austria-Hungary, with a representation from other European states and Canada, Latin America, and Japan. The foreign attendance rather exceeded expectations, as it was known from the first that a large number of European geographers, teachers, and students usually participating in these Congresses would be prevented, by the time, distance, or expense involved, from visiting America. The geographical societies of this country were very much gratified that so many representative foreigners were able to be present.

It is possible here to mention only a few of the foreign guests. They included from Great Britain—Dr. H. R. Mill, Sir John Murray, Major A. St. H. Gibbons, the African explorer, and Prof. H. Yule Oldham, of Cambridge University; from Germany—Prof.

Oskar Drude, Dr. Prof. Kurt Hassert, of Cologne; Dr. Adolf Marcuse, and Graf Joachim von Pfeil u. Klein Ellguth; from Austria-Hungary—Dr. Béla Erödi, of Budapest, President of the Hungarian Geographical Society, and Profs. Drs. Oberhummer and Penck, of the University of Vienna; from France—Prof. Paul Vidal de la Blache, of the University of Paris; Prof. Henri Cordier, President of the Paris Geographical Society; Mr. Guillaume Grandidier, who has for years been associated with his father in his studies and publications relating to Madagascar, and Prof. Julien Thoulet, the Oceanographer and Professor of Geology at the University of Nancy; and from Switzerland—Dr. Arthur de Claparède, President of the Geographical Society of Geneva. These gentlemen, and not a few other foreigners, were very prominent in the scientific and business meetings and the social affairs of the Congress.

There was also an important number of European members, who, though unable to be present, enriched the scientific programme with their contributions, some of them accompanied with maps all ready for reproduction. They include contributions by A. Chevalier, who has recently returned from his scientific mission to the French Central Sudan; Prof. E. T. Gautier, of Algiers, who has made special studies of the commercial value of the French Sahara; Prof. Dr. Kan, of the University of Amsterdam, who wrote on Progress in the Dutch East Indies; Captain P. Kozloff, one of the Russian explorers of inner Asia; Prof. E. Levasseur, E. A. Martel, and Charles Rabot, of Paris; Prof. Dr. Karl Sapper, the explorer of Central America and Professor of Geography at the University of Tübingen, and Mr. David Lindsay, the Australian explorer. The participation of these and other distinguished specialists in geography, who added material of value to the output of the Congress, although they were unable to attend it, was highly appreciated. Most of the papers by absent members, home or foreign, were read by title only, as time lacked for the reading of many accepted contributions.

The presence of nearly all the leading geographers of the United States from different departments of the General Government and from the Universities and higher schools was noteworthy, for they had never been numerically well represented in the earlier Congresses. They strengthened the Congress, particularly in the sections dealing with the various branches of physiography, mathematical geography, geographical technique, and economic and educational geography.

In some respects the American meeting departed from precedents that had become established in the preceding Congresses. It was deemed necessary for a number of Societies to participate in arranging for the Congress, though heretofore the responsibility of organization has always devolved upon one Society. Of course, this method was exceedingly cumbrous and wasteful of energy and time. Several men repeatedly travelled 200 or 300 miles to attend the committee meetings, some of whose members were actually as far apart as the Atlantic and Pacific seaboards. This experiment will probably never be repeated; that it was measurably successful was due to the untiring efforts of the Societies.

It was also a decided innovation to distribute the sessions among six cities of the country, involving a journey of over 1,200 miles inland between the opening and the close of the Congress. The foreign members, at least, had not been accustomed to interposing long nights of railroad travel between fatiguing days in Congress sessions. This tax on mind and body was relieved *en route* between Washington and St. Louis by such pleasurable incidents as the days at Philadelphia and Niagara Falls and the Hudson River excursion of the American Geographical Society. The results of the innovation were not unfortunate, and the guests, on the whole, rather enjoyed the opportunity to see something of America, its cities and people, while the Congress was in session.

The general meetings were fewer and the section meetings more numerous than at the London and Berlin Congresses. No topics of commanding interest—such as the African and Antarctic meetings in London, and the Antarctic programme at Berlin—were before the Congress, and although three half-days in Washington, New York, and Chicago were given to the opening exercises and to selected papers, most of the programme was carried out in the section meetings. Whenever the Congress was not in general session, three of these meetings were simultaneously in progress in Washington and four during the days in New York. In London and Berlin the papers read in the section meetings were those that appealed chiefly to specialists, while here some of the most popular topics, such as Exploration, were mainly confined to the section rooms. As has always been the case abroad, the section meetings were not very well attended, with the exception of Physiography of the Land and Oceanography.

An innovation that was well liked was the ample facilities for illustrating the papers with maps and lantern-slides. In New York each of the four section rooms was provided with a lantern, and

many papers were illustrated. About 125 papers were submitted. The contributions at Berlin were only a little more numerous. Only two or three papers were written in Italian or Spanish, though these were included with English, German, and French as the languages of the Congress.

A considerable number of the papers from continental Europe were presented in English. Daily programmes, in English, were printed for the Washington and New York meetings. No geographical exhibition was given in direct connection with the Congress, but in New York the New York Public Library exhibited at the Lenox Library building about 200 examples of its remarkable map collection, including many of the most famous pre-Columbian maps. A printed hand-list gave full information, and some of the members were able to accept the special invitation to attend the exhibition. In St. Louis no special arrangements appear to have been made to direct members to the exhibits of large geographical interest.

It was, of course, the desire of the American hosts to welcome the foreign guests with the heartiest hospitality, and to make the occasion a pleasant memory to all. The various entertainments will be mentioned in the following brief report of the meetings.

### THE WASHINGTON MEETING.—Sept. 8–10.

The members met first at an informal reception at Hubbard Memorial Hall on the evening preceding the opening of the Congress. On Thursday morning, September 8, the opening exercises occurred at George Washington University Hall. In the absence of the President of the United States, who was not at the capital, the Congress was welcomed to this country, in his behalf, by Dr. Charles D. Walcott, Superintendent of the United States Geological Survey, and by Dr. G. K. Gilbert, on behalf of the National Geographic Society. Short but felicitous responses on behalf of the foreign delegates and Societies were made by Professors Cordier, Penck, and Oldham.

In introducing Dr. Gilbert to the Congress as the acting head of the National Geographic Society, Commander R. E. Peary, C.E., U. S. N., President of the Congress, said that it was due to this Society and its founder, Gardiner G. Hubbard, that the Eighth Congress had been brought to America.

President Peary, in his opening address, summed up the more important features of geographical discovery and progress in the past nine years, and treated briefly and broadly the work yet to be done in the field of pioneer research. He expressed the hope that

the Congress would not ignore the Arctic area, with its five expeditions now in the field or preparing to enter it; and he would like to see America carry forward the Antarctic explorations which our friends across the water had so splendidly begun and prosecuted for four years.

The afternoon was spent in visiting the Government scientific bureaux under the guidance of committees.

The papers on Physiography of the Land, Geodesy and Geographical Technique, Meteorology and Terrestrial Magnetism, Glaciers and Bio-geography had been assigned to the Washington meeting.

Friday morning was devoted in general session to Governmental Surveys. Among the papers was one by Dr. Marcuse, dealing with the progress made in instruments and methods for determining geographical positions on land, ship positions at sea, and the position of balloons in the air. Prof. Hayford described the most recent practice of the U. S. Coast and Geodetic Survey in triangulation, base measurement, and levelling. Mr. Littlehales, speaking on the marine hydrographic surveys of coasts, said that while there is only a comparatively small total extent of completely surveyed coast, the extent of coast that is unexplored for purposes of navigation is still smaller, and is almost wholly confined to the frozen regions; and there is an immense extent of the coast-line which cannot be navigated with security, though it is sufficiently known to be approached. Prof. Penck spoke on his project for a map of the world on a scale of 1:1,000,000, introduced by him at the Berne Congress, and which, under his initiative and with the support of every succeeding Congress, has already made important progress. The Eighth Congress, as seen in the resolution printed below, urges the United States to make a map of our country on the same scale, as France, Germany, and Great Britain are now doing in their territories. Other papers were in this list, but it is impossible even to mention here many of the papers presented in the various sections.

## SECTIONAL MEETING.

This sectional meeting, in which papers on Physiography of the Land were read, was disappointing to many of those present, inasmuch as ten out of the twenty announced authors of papers were absent, and only two of the speakers were Europeans. Of the papers presented, The Sculpture of Massive Rocks, by Gilbert, was notable for the excellence of its illustrations by views from the Sierra Nevada of California; Island Tying, by Gulliver, treated

a special problem of shore topography; The Classification of Mountains, by Rice, dealt with the structural aspects of this mooted question; The Origin of Alpine Lakes, by Penck, gave much importance to glacial erosion; while The Relief of the Southern Carpathians, by de Martonne; Physiographic Aspects of China, by Willis; The Bearing of Physiography on Suess's Theories, by Davis, and a paper on The Alps, given by Penck in Chicago, all bore independent testimony to the broad uplift and deep dissection of various mountain masses, whose deformed structures were due to crushing in some earlier period, separated from that of the broad uplift by a long cycle of erosion. The coincidence of this testimony was perhaps the most distinct feature of this sectional meeting, as it extended to Europe and Asia a conclusion that had been familiar for some years in American examples.

Nine of the twelve papers relating to Meteorology and Terrestrial Magnetism were read. Prof. Stupart described the climates of the different climatic provinces of Canada, noting the most striking features in each case, and laying special emphasis on the favourable conditions for agriculture in the western and northwestern provinces, where it was formerly supposed that everything was bleak and bare. These favourable conditions are chiefly the result of the high summer temperatures, the summer isotherms trending far north on the eastern side of the Rocky Mountains. Dr. Mill illustrated with lantern-slides some studies he has recently made of the distribution of the amounts of rainfall around certain selected individual cyclones in the British Isles, and brought out the importance of a consideration of this cyclonic control in any complete investigation of the precipitation of any country. This paper had just previously been presented at the meeting of the British Association for the Advancement of Science in England. Dr. Bauer showed a series of interesting curves recorded by the magnetic instruments at a number of observatories in both Northern and Southern Hemispheres at the time of the great eruption of Mont Pelé. The marked irregularities of these curves, all closely alike, were most striking, and suggest many questions concerning the nature of the disturbance at Mont Pelé and its various effects. The paper of Prof. Henry, of the U. S. Weather Bureau, called attention to the new climatological summaries for the United States which the Weather Bureau has undertaken to publish for all its stations. This plan will bring together all the available data in one publication, which will be a great convenience to those who have occasion to use such tables. Prof. R. DeC. Ward emphasized the need of

giving more attention to the cyclonic control of the climatic elements. Too much emphasis is now laid on the regular annual, seasonal, monthly, and diurnal variations, and too little on the irregular, but important, cyclonic variations. The paper was illustrated with lantern views, showing different temperature curves for New England, in which an understanding of the cyclonic control was seen to be of paramount importance if any rational view of the climate is to be gained.

Mr. Littlehales set forth the aims of the Navy Department in the collection of observations of the declination and inclination and of the intensity of the earth's magnetism, and gave an account of the discussions which have been undertaken for the production of world charts of the three magnetic elements and for the assignment of the correct direction of the magnetic meridian on charts constructed for purposes of navigation.

In the Bio-geographic section Dr. Oskar Drude read a paper, *Die Methode der Pflanzengeographischen Kartographie, erläutert an der Flora von Sachsen: Nomenklatur pflanzengeogr. Formationen*, which presented the results of a study and mapping of the floral regions of Saxony, with remarks on the colour scheme of the maps. Dr. Harshberger's "Method of Determining the Age of the Different Floristic Elements in the Eastern United States" was a differential study of the age of the plant formation of eastern America. Dr. Gill's "Origin of Fresh-water Faunas" was an important paper bearing on the evolutionary origin of fresh-water animals. Dr. H. C. Cowles read a paper on "The Remarkable Colony of Northern Plants along the Apalachicola River, Florida," which described an association of plants found on the bluffs of the river mentioned.

An interesting paper of a more popular character was presented by Middleton Smith, Washington, D. C., who described the habits and northern range of the resident birds of Point Barrow, Alaska.

An important communication, "The American Range of the Cycadofilices," was made by David White, Washington, D. C., with exhibition of specimens, illustrating the connection between cycads and ferns, both in external morphology and internal structure. Dr. Charles C. Adams spoke concerning "The Dispersal Centres of North American Biota," contrasting the original centres from which the plant and animal forms of the continent were dispersed.

One of the agreeable events was the reception at the U. S. Naval Observatory by Rear Admiral C. M. Chester. Arrange-

ments for the exchange of international time signals and messages with observatories and institutions all over the world were successfully carried out, and many of the replies, received in several languages, were read when the Congress reconvened next morning.

After the adjournment of the section meetings on Friday a reception was given by Mrs. G. G. Hubbard, at her beautiful country home, a little outside of Washington. That evening Mr. Charles M. Pepper lectured on "The Bolivian Andes." On Saturday a brilliant reception by President and Mrs. Peary was given in the large ballroom of the New Willard. The Chinese, Turkish, Swiss, and other Ministers, the Italian Ambassador, and members of various other legations were present. The orchestra played the national airs of all countries whose delegates were present, and this was done also at the Philadelphia and New York dinners.

On Sunday many members made an excursion on the Potomac to Mount Vernon, and that evening the Congress went to Philadelphia by special train.

PHILADELPHIA DAY—SEPT. 12.

The committee of the Geographical Society of Philadelphia had decided to make the most of the single day at their disposal by giving their guests an opportunity to see the city. In carrying out this plan, the idea of holding any session for reading papers, etc., had to be abandoned.

On the arrival of the train from Washington the members were met by a committee and taken to the Hotel Walton. At 9 o'clock the next morning the entire party, with the local committee, drove to Independence Hall and the rooms of the American Philosophical Society—the oldest scientific association in the United States. The coaching party then went through the business and industrial districts to the Commercial Museum, where the Director, Dr. W. P. Wilson, explained the workings of the Museum. After an inspection of the building the members of the Congress were entertained by the University of Pennsylvania at Houston Hall, and an hour was spent in examining the Free Museum of Science and Art.

A trip through Fairmount Park, and along the Wissahickon Drive, ended at the Philadelphia Country Club, where a dinner was spread in the open porches of the club, specially arranged for the occasion.

President Peary made the opening address, and was followed by Mr. Henry G. Bryant, the President of the Philadelphia Society, who welcomed the Congress to the city and acted as toastmaster.

Among the speakers of the evening were Dr. Hugh R. Mill, Royal Geographical Society, London; M. Henri Cordier, Geographical Society of Paris; Count von Pfeil, Germany; Dr. Béla Erödi, Hungary, and Mr. Eki Hicki, Japan. At the conclusion of the dinner the guests took a special train to New York.

### THE NEW YORK MEETING—Sept. 13–15.

The three days in New York were under the auspices of the American Geographical Society, whose house was entirely given to the work of the Congress and the convenience and comfort of its members. All the foreign representatives were the guests of the Society, which paid their travelling expenses from Washington and provided hotel accommodations in New York. The general sessions were held in the Society's lecture hall, but three of the four section halls and the large auditorium were provided by the kind co-operation of the American Museum of Natural History, whose Director, Dr. Bumpus, was untiring in his efforts to give the Congress every helpful accommodation.

In opening the New York meeting in the hall of the Society, President Peary referred to the fact that this year marks both the completion of the first half century of the existence of the American Geographical Society and the first meeting in New York of the International Geographical Congress.

Nearly all of the Congress business was transacted in New York, which, also, had a larger share of the section meetings than other cities. The sections of Oceanography, Volcanoes and Earthquakes, Exploration, Economic Geography, and Education were almost continuously in session for a day and a half.

The general session of Tuesday forenoon very appropriately opened with an appreciation of the late Friedrich Ratzel by Dr. Martha K. Genthe, one of his pupils. Sir John Murray followed with an address on deep-sea exploration, in which he spoke of two manuscript maps, prepared under his direction, embodying the latest information as to depths and the distribution of life in the deep-sea areas. Count Joachim von Pfeil told of the rise and development of the German Colonial possessions, and Dr. E. O. Hovey gave a description of the volcanoes of Martinique, Guadeloupe, and Saba.

The meetings of the Oceanography Section drew very good audiences. Prof. Thoulet presented a number of papers descriptive of the work of the Oceanographical Laboratory at Nancy, of which he is the Director, with special reference to recent investigations

in the neighbourhood of the Azores. He also gave a résumé of the investigations carried on under the direction of the Prince of Monaco from 1885 to 1904, and exhibited the first copy of the great atlas prepared by the Prince of Monaco, after the plans adopted by the Committee appointed at the Seventh Congress in Berlin. This atlas is being executed by Profs. Thoulet and Sauerwein, and will cover some twenty-four sheets. Depths are given in metres, and the terminology is that prepared by Dr. Supan and adopted at the meeting at Wiesbaden.

Prof. Penck reported upon the recent investigations carried on in the Adriatic. Among other papers were two by Mr. R. A. Harris, one upon the co-tidal lines for the world, and the other upon the evidence of land near the North Pole; on the oceanic history of Cape Cod by Prof. Niles, of Boston; on the attempts to locate some islands in the North Pacific Ocean between Hawaii and Panama and the proof that the islands are mythical, by Mr. James Hague; and on the currents and climatology of the North Pacific, by Prof. Davidson, of San Francisco. The discussion of papers was in some instances as important and interesting as the papers themselves. The investigations upon which the papers were prepared are of great value from a practical standpoint, as the results obtained have a bearing upon commerce and navigation, as well as on the development of the fishing industries.

Only about a third of the papers on explorations could be read. It had been hoped to make a special feature of the Antarctic work, but Dr. Drygalski was prevented at the last moment from attending the Congress. The following papers were read: By the Rev. J. N. MacGonigle, on the Everglades of Florida; by Robert T. Hill, on the physical geography of New Mexico, and by G. R. F. Prowse, on the Cabot landfall. Dr. A. Donaldson Smith described Africa between the River Jub and the Nile, and Maj. A. St. H. Gibbons, of London, spoke on methods of exploration in Africa. Papers by Ellsworth Huntington "On Evidence of Climatic Change in Eastern Persia," and by Col. Ch. Chaillé-Long on "Les Provinces équatoriales de l'Égypte," belonged to the Meteorological and Historical Sections. Henryk Arctowski described from notes, with lantern-slides, the glaciers of the Antarctic, particularly of Tierra del Fuego, and of Graham and Danco Lands, and Chairman Bryant reported the discovery among the documents of the Historical Society of Pennsylvania of an account of the first Arctic expedition, in 1752, to explore the North-West Passage. It sailed on the schooner *Argon*, which was wrecked on the Labrador coast. All

of the papers were discussed. A pleasing incident was the presentation by President Cordier, of the Paris Geographical Society, of a silver medal to Frank W. Stokes, in recognition of his artistic work in the Arctic and Antarctic.

Six papers were read in the Economic Geography Section. The first paper was by Prof. Emory R. Johnson, of the University of Pennsylvania, on the subject of "Some Governmental Influences affecting the Geographic Distribution of Commerce." The paper called attention to the changes which have taken place in the distribution of the foreign commerce of the United States; and also showed that the commerce of the northwest continental ports of Europe is growing at a more rapid rate than the commerce of British ports. Mr. A. de Claparède, of Switzerland, discussed the "Economic Importance of Switzerland," and also gave a summary of a paper which he had prepared on "The Present Status of Economic and Social Geography." Mr. O. P. Austin, Chief of the Bureau of Statistics, discussing the relations of commerce to geography, expressed the view that the great work of the present century would be to make the share contributed to the requirements of man by the tropical area more proportionate to its size and population. Dr. Thorndike advocated the desirability of establishing game preserves in the swampy territory called the "Muskeg region," south of Hudson Bay and the Barren Lands, a breeding-ground and abode for many of the game and fur-bearing animals. A permanent fur trade would be developed by maintaining preserves for these animals and the condition of the Indians in the region would thereby be improved. Dr. J. F. Crowell, Commerce Expert of the United States Bureau of Statistics, discussed in detail "The Geographic Influences affecting the Development of the Internal Commerce of the United States." Prof. J. Russell Smith, of the University of Pennsylvania, submitted a paper upon the "Economic Importance of the Plateaus in Tropical America." The papers presented, it is believed, together with others contributed but not read, will constitute a valuable addition to the literature of Economic Geography.

All the papers in the Section of Volcanoes and Earthquakes were illustrated by slides and maps.

Prof. Hitchcock's paper on Hawaiian Geography brought out the relationships of the different volcanic vents, particularly those of Hawaii, and showed that volcanic activity has advanced from the northwest toward the southeast in the chain, and subaerial erosion has progressed more rapidly upon the windward

(eastern) sides than upon the dryer western slopes. Prof. Robert T. Hill, in a paper on The Larger Story of Mont Pelé, emphasized the idea that the recent eruptions are minor incidents in the geologic history of the islands, which have been built up from the sea-bottom by successive eruptions. All the Lesser Antilles are to be regarded as mountains of accretion and not as the tops of a range which has been drowned by subsidence.

Prof. Angelo Heilprin, in a paper on the Destruction of Pompeii, considered that the eruptions of Pelé throw new light upon the first recorded eruption of Vesuvius. The "horrible black cloud" of which Pliny wrote is seemingly the counterpart of the great descending black cloud, similarly charged with electricity, which was the distinctive feature of the Pelé eruption of May 8, 1902. The speaker expressed his conviction that Pompeii was not destroyed as the result of simple incineration, but in a manner closely similar to that which annihilated St. Pierre. The numerous deformed objects of porcelain, glass, etc., which, as recovered from Pompeii, were thought to represent long periods of time effecting their deformation have again their exact counterpart in objects recovered from St. Pierre, where the deformation was accomplished in minutes or seconds.

Dr. E. O. Hovey, of the American Museum of Natural History, gave two papers upon the volcanoes of the Caribbean Islands, the first of which is referred to above as delivered in the General Session. The second, read in the Section meeting, was on "The Volcanoes of St. Vincent, St. Kitts, and Statia" (St. Eustatius).

Prof. Dr. A. Schmidt, of Stuttgart, speaking on "Vertikale Bodenbewegungen beobachtete mit dem Trifilargravimeter," said he had found that the earth's crust is transmitting waves which have not been heretofore suspected. These waves are long between crests, four to five minutes elapsing between maxima, and are about seven inches in height. On account of their slowness and regularity, these vibrations recorded by the apparatus cannot be regarded as caused by the wind. They are crustal movements, but their meaning is not yet clearly understood.

The papers in the Education Section were chiefly by American teachers. Dr. Béla Erödi gave an interesting account of the progress of geographic science in Hungary.

On the first day of the New York meeting the American Geographical Society gave a luncheon to the Congress at the American Museum of Natural History; and in the evening, after the lecture at the Museum by Dr. and Mrs. Bullock Workman on their latest

mountaineering expedition among the Himalayas, a reception at the house of the Society was attended by nearly all the members of the Congress and many Fellows of the Society. Between the morning and afternoon sessions on Wednesday the American Museum of Natural History entertained the Congress at luncheon; and that evening the American Geographical Society gave a subscription dinner complimentary to the foreign guests at the Hotel Endicott. At the dinner M. Henri Cordier, President of the Paris Geographical Society, delivered to President Peary the gold medal unanimously voted to him by that Society for his achievements in Arctic exploration.

All the conditions worked together to make the excursion up the Hudson River on the 15th of September in every way memorable. The American Geographical Society had chartered a steamboat for the Congress and the many Fellows of the Society, who, with their families, had accepted the invitation for the day. The point of destination was Mount Beacon at Fishkill, which was reached in about four hours. The guests were greatly interested in the physiography of this region, and the Society distributed a printed description written by Prof. W. M. Davis for the occasion. He also conducted the field party to the summit of Mount Beacon, from which was obtained a splendid view of the Hudson River valley and the bordering mountains. Returning from Fishkill, the excursionists stopped at West Point to accept the courtesies tendered before the meeting of the Congress by Brig.-Gen. Mills, the Superintendent of the United States Military Academy. A guard of honour escorted the visitors to the parade ground, where the corps of cadets went through their evolutions.

From West Point the members of the Congress took the train to Niagara Falls.

## MEETINGS WEST OF NEW YORK.

The field day at Niagara Falls on Sept. 16 was greatly enjoyed. It was introduced with a lecture on the Falls by Dr. G. K. Gilbert, who also conducted the Congress to the many points of interest.

The journey was continued that evening, and Chicago was reached on the morning of the 17th inst. The Congress was received in Kent Theatre, University of Chicago, where President Harper, of the University, delivered an address of welcome, to which President Peary responded. The remainder of the forenoon was given up to a short programme of scientific addresses, in which Professors Penck, Salisbury, and Goode, Dr. Mill, and Mr. Gran-

didier took part. A luncheon complimentary to the members of the Congress, drives to the Field Columbian Museum and through the parks, and a reception at the Chicago Historical Society filled the rest of the day.

Sunday was spent on the train making the journey, through incessant rain, across the prairie State of Illinois to St. Louis. Some of the members improved an opportunity on the way to pay a short visit to the underground workings of a coal-mine. St. Louis was reached that evening, and the following four days, until the final adjournment on Sept. 22, were spent in that city. A few papers in the sections Historical Geography and Anthropogeography were read in meetings of the World's Congress of Arts and Sciences. A reception to President Peary was given on the evening of Sept. 20, and his lecture at Festival Hall on Sept. 22 was heard by an audience that filled the great auditorium. The final meeting was held immediately after the lecture, when the President made the following remarks in closing the Congress:

### President Peary's Closing Address.

We are assembled here for the last meeting of our Congress. Whether the Congress has been a success or not rests with the judgment of time and yourselves. I believe we are justified in looking upon its work with satisfaction.

One thing may be said. In every Department of this Congress the papers read have shown a distinct step in advance since the last Congress, and in many Departments there has been progress not merely to a higher plane but to an entirely new horizon.

The number of resolutions adopted by the Congress is less than usual. Those adopted, it is believed, are worthy of an International Organization. The salient resolutions of the Congress are those relating to

Map of the World, 1:1,000,000;
Polar Exploration;
Oceanography;
A World Census.

These are unequivocally international subjects. An universal map to a uniform scale; an universal census; the conquest of the only remaining great unknown areas of the globe; the prosecution of the study of the great subaqueous world, in which but a beginning has yet been made, in spite of the work of Murray and others.

There has been no specially prominent topic before the Congress, no one overshadowing subject, as in the two preceding Congresses. The Congress has moved on lines of general, equable development. We from America have been broadened by the presence of the Congress; we are under deep and lasting obligations to it for its certain stimulus to geographical interest and work in this great country. A very gratifying feature has been the strong and satisfactory showing of our own home geographers. At no previous Congress have so many of our leading men been present.

If you from abroad have received ideas and impressions which may in any way

assist you in your methods, or round out and make more complete your work and results, we shall be proud and pleased.

One feature of the Congress has been an innovation—its migratory character. Whether this has been a desirable innovation rests with you to decide.

We are indebted to our friends and visitors from abroad who have devoted such share of time and effort to coming to us here; and we are doubly indebted to those who have brought their ladies along to charm and brighten our proceedings.

As for the ladies themselves, that they have braved the terrors of the sea and a new land to be present proves them brave as well as fair.

We regret those other friends whom stress of unavoidable circumstance has kept from coming. Two weeks of social and technical contact and association with brains and culture, from every civilized portion of the earth, is an episode in the life of any one. When to this is added the camaraderie of travelling companions, the combination is nearly ideal.

If in any way we have failed in making this period and our journeyings pleasant to our friends and visitors, believe me it is not for lack of will or disposition.

The Congress is under obligations to the National Geographic Society, the Philadelphia Geographical Society, the American Geographical Society, the Geographical Society of Chicago, and the local committees in Washington, Philadelphia, New York, Niagara Falls, Chicago, and St. Louis for their efforts to make the stay of the Congress pleasant.

It is under double obligations to the Committee of Arrangements, and the Committee on Scientific Program. The labours of both, owing to the movements of the Congress, have been particularly arduous, and, as it were, never-ending. These remarks would be incomplete without specific mention of Drs. Day and McCormick, Mr. Adams, and Profs. Davis and Libbey, each of whom has been invaluable.

Personally I deeply regret the ending of this most enjoyable occasion.

I hope that we shall all meet again at the next Congress to report still greater advances in our science; but if it be willed that some of us shall reach that end which comes to all men soon or late, may it be with a record of good work and lasting good accomplished for science and geography.

With sincerest good wishes for our successor, the Ninth International Geographic Congress at Geneva, I will, if there is no further business to come before the meeting, declare the Eighth International Geographic Congress closed.

## Resolutions Adopted by the Eighth International Geographic Congress.

In the following list the resolutions are arranged according to the departments of geography with which they deal. Some of them are reaffirmed from the Seventh Congress:

Map of the World on a Scale of 1 : 1,000,000 (*Introduced by Prof. Penck*).—1. The Eighth International Geographic Congress presents its thanks to the Service Géographique de l'Armée at Paris, to the Kartographische Abteilung der Königlich-Preussischen Landesaufnahme in Berlin, and to the Intelligence Division of the War Office at London, for having commenced the publication of large maps on the scale of 1 : 1,000,000, which correspond in a

general way to the maps of the world, proposed by the Congress at Berne, and it invites these offices to prepare an account of their maps, accompanied, if possible, by parts of them, for publication in the report of the Washington Meeting.

(*Introduced by Prof. Penck*).—The Congress proposes to the Government of the United States the execution of a general map of America, on the scale of 1:1,000,000, similar to those maps on the same scale of parts of Asia, China, and Africa now in preparation by the Service Géographique de l'Armée at Paris, by the Königlich-Preussische Landesaufnahme in Berlin, and by the Intelligence Division of the War Office at London; each sheet of the map being projected separately, and being limited by parallels 4 degrees apart and meridians 6 degrees apart; the initial meridian being that of Greenwich, the initial parallel the Equator; the standard of measures being the metre.

CARTOGRAPHICAL ASSOCIATION (*Introduced by Prof. Penck*).—The Congress refers the proposition of Mr. Schokalsky and the paper of Mr. Schrader to the Committee appointed at the Congress of Berlin concerning the Cartographical Association. This Committee is requested to report on the necessity of a Cartographical Association to the next Congress. In the meantime it might interest Geographical Societies in the plan and in the necessity of dealing with maps in geographical journals in a more detailed way than usual, and urge that a general use of maps should be popularized and extended by instruction in schools, and the commerce with maps should be better organized.

The Committee being now reduced by the death of General Tillo, and the withdrawal of General Steinmetz to Mr. Schrader, the Congress appoints the following gentlemen to the Committee:

Mr. Henry Gannett, Washington (Chairman); Jules de Schokalsky, St. Petersburg (successor to Gen. Steinmetz); Mr. Franz Schrader, Paris; Prof. E. Oberhummer, Vienna; Mr. J. G. Bartholomew, Edinburgh.

INTRODUCTION OF THE FRACTIONAL SCALES ON MAPS.—The Seventh International Geographical Congress expressed the urgent wish that upon all charts, including those published by those lands still employing the English and Russian systems of measurements, along with the scale of geographic co-ordinates, the scale of reduction should be expressed in the usual fractional form 1 : x, and that the latter be added to all lists of charts covering land and sea, and requests the Executive Committee of the Congress to bring this

decision to the attention of all Governments, Geographical Societies, and establishments engaged in the publication of charts. The advantage to be derived from the support of this resolution, which has its origin with the editor of *Petermanns Mitteilungen*, and the extensive dissemination of the resolution, is at once evident. In English publications a custom has arisen of adding a statement of the ratio 1:x to the usually employed x miles to one inch. In America the custom has arisen of going even a step beyond this—namely, the addition of the ratio of reduction has led to the direct application of the decimal system in the units of measure adopted upon the chart. To this Geographical Societies are urged to give wide publicity.

RULES FOR GEOGRAPHIC NAMES.—Local names are as far as possible to be preserved not only in those regions where already established, but also in wild regions. They should on this account be determined with all the accuracy possible.

Where local names do not exist or cannot be discovered, the names applied by the first discoverer should be used until further investigation. The arbitrary altering of historical, long-existing names, well known not only in common use but also in science, is to be regarded as extremely unadvisable, and every means should be employed to resist such alterations. Inappropriate and fantastical names are to be replaced, as far as possible, by local and more appropriate names.

The above rules are not to be rigorously construed; yet they should be followed to a greater extent than heretofore by travellers and in scientific works. Their publication in periodicals as the opinion of the Congress will probably prove of great weight. Although in recent years many official systems of determination of geographic names have been enunciated, we have still evidence of the very slight influence which the wishes of the International Geographic Congresses exert over the decision of the official authorities. To this Geographical Societies are urged to give wide publicity.

PUBLICATION OF PHOTOGRAPHS (*Introduced by Prof. Penck*).—It is suggested by the lantern-slides shown by Mr. Siebers and by the photographs by Mr. Willis that it is desirable that in these and the cases of other exploring travellers photographs of geographical significance might be published, and accompanied by short explanatory notes, so that they may form collections of representative physical features of different parts of the world.

Polar Exploration (*Introduced by Sir John Murray*).—The Eighth International Geographic Congress, realizing that the only untouched fields for geographical discovery are the regions immediately surrounding the poles of the earth, desires to place on record its sense of the importance of forthwith completing the systematic exploration of the polar areas. It is very desirable that the experience gained by men of science and officers in the recent Antarctic expeditions should be turned to account, by following up without delay the success they have obtained. The Congress recognizes that the Arctic regions possess a more immediate interest for the people of North America, and expresses the confident hope that the expeditions now being prepared will be so supported as to secure early and complete success.

Deep-Sea Maps and Nomenclature of the Earth's Bottom.—The Eighth International Geographic Congress expresses its thanks to His Serene Highness the Prince of Monaco for having executed the map of the ocean, the preparation of which was desired by the Congress of Berlin, and expresses especially its agreement with the scale and projection chosen, with the adoption of the initial meridian of Greenwich, with the adoption of the metre for indication of the depths, and the system of international submarine terminology used.

Collection of Records of Drift Ice.—This work is progressing satisfactorily in charge of the Danish Meteorological Institute and the co-operating offices and through their systematic collection of records of drift ice.

Earthquake Investigation.—The International Seismological Association has accomplished the wishes of the Seventh Congress. *Resolved*, that the Eighth International Geographic Congress sends its congratulations to the International Seismological Association, whose further work is waited for with great interest.

Standard Time (*Introduced by Mr. E. E. Hayden*).—*Resolved*, in view of the fact that a large majority of the nations of the world have already adopted systems of standard time based upon the Meridian of Greenwich, as prime meridian, that this Congress is in favour of the universal adoption of the Meridian of Greenwich as the basis of all systems of standard time.

The Decimal System.—The Congress expresses itself in favour of a uniform system in all geographical researches and discussions, and it recommends for this purpose the employment of the metric

system of weights and measures, as also the employment of the centigrade thermometric scale. It is, moreover, highly desirable that there should always be added to statements of the Fahrenheit and the Réaumur scales their equivalent upon the scale of Celsius.

Similar is this question of the metric system, which reaches even more deeply than the former into the well-established customs of daily life, and has proved not without value in promoting international uniformity and simplicity. Although the metric system of weights and measures has made slow progress, and this alone through the portals of scientific work, its application to geophysics and geography has already made a fair beginning. In England a special organization entitled the Decimal Association has taken charge of the matter. The Commonwealth of Australia has entrusted the subject to a commission. We are without knowledge of the efforts in this direction thus far made in Russia. To this Geographical Societies are urged to give wide publicity.

STATISTICS OF POPULATION IN COUNTRIES WITHOUT CENSUS (*Introduced by the Hon. Carroll D. Wright, U. S. Commissioner of Labor*).—Moved, that a committee of five be appointed by the President to confer with a Committee of the International Statistical Institute on methods of obtaining the population in countries taking no census. (Mr. Henry Gannett was appointed Chairman of the Committee.)

A COMMITTEE TO CONDUCT THE BUSINESS OF THE CONGRESS (*Introduced at St. Louis*).—*Resolved*, that the President appoint a committee of five, of which he shall be *ex-officio* chairman, with power to add to their number, to conduct the business that may arise from this Congress and to report to the Ninth International Geographic Congress.

Geneva, Switzerland, was designated as the place for holding the Ninth International Geographical Congress in 1908.

The morning after the adjournment of the Congress about seventy-five of the members started on an excursion to the Grand Cañon of the Colorado and the City of Mexico. The trip was successful, though washouts in Mexico caused considerable delay and there were other adventures not on the programme. Two days were spent at the Grand Cañon. In Mexico a reception to the Congress was given by President Diaz at his country home, and the party also visited Mount Orizaba. The excursionists returning to New York arrived about October 12th.